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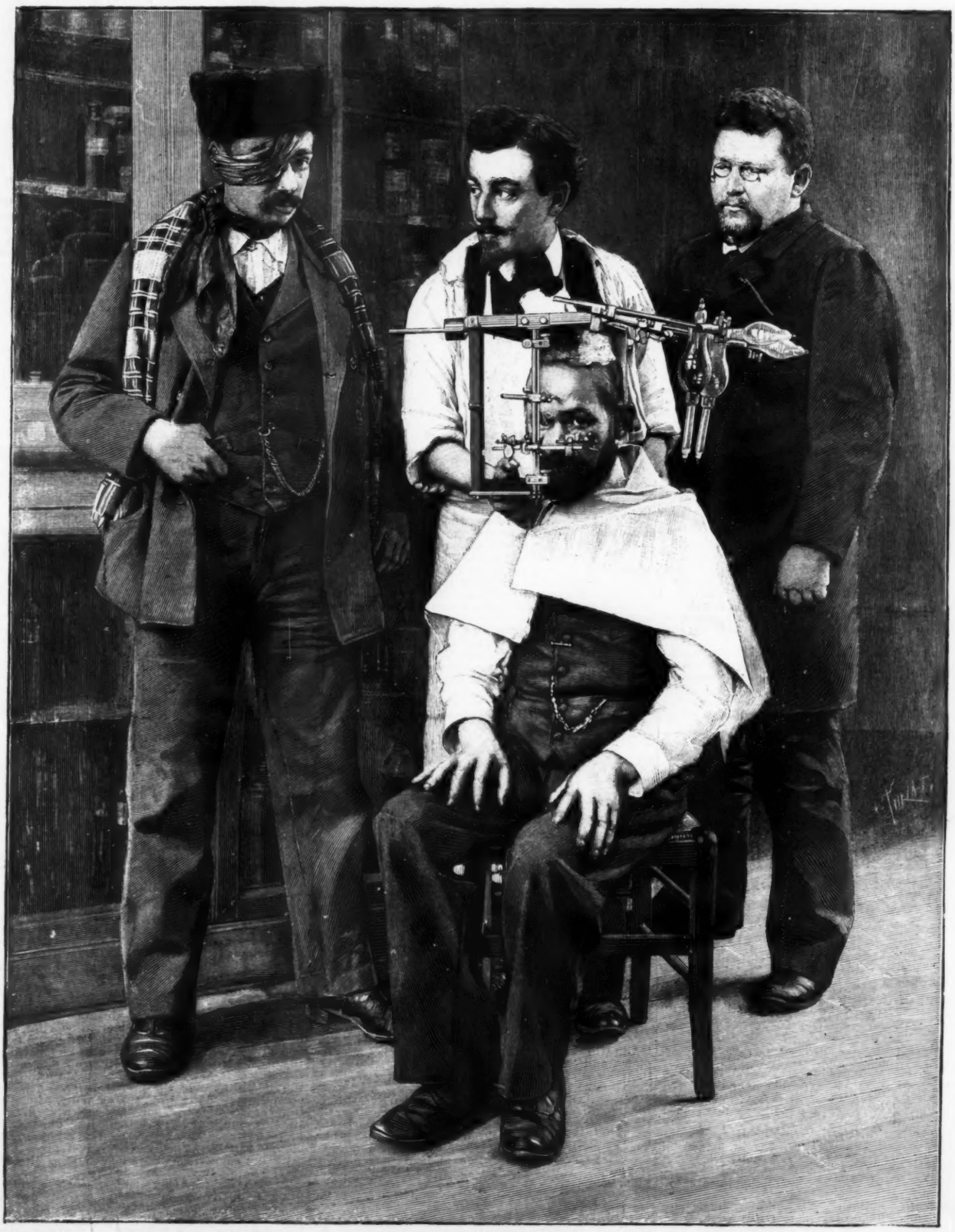


APPARATUS FOR DETECTING WITH THE AID OF CROOKES TUBES THE LOCATION OF FOREIGN BODIES.

NEW SYSTEM FOR LOCATING BULLETS.

THE surgeons were the first to comprehend the practical importance of the discovery of the X rays. But a few days elapsed after the never-to-be-forgotten communication by Prof. Roentgen before the hospitals of Paris were using the "radiograph" or the "radioscope" for locating foreign substances introduced into the bones or tissues of human bodies.

But the surgeons were not long in discovering the fact that it was imprudent to exact too much from these rays. They did not always indicate the precise location of these foreign substances, and the operator sometimes risked the patient's life by depending too completely on the insufficient indication given by the X rays.

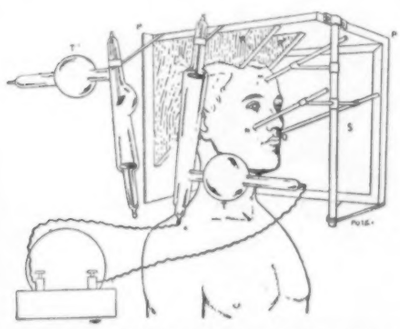
It was ascertained without a doubt that the radiograph, even with the aid of clinic signs, was manifestly impotent—this fact has been proved by repeated experiments—to positively locate a ball which had been fired into the brain by a murderer's or suicide's hand.

FINDING THE DIRECTION OF THE BALL WITH THE COMPASS.

Was it possible that this collaboration with the X rays, from which so much had been hoped, would prove a failure? Surgeons had been forced to this conclusion much against their will, when, fortunately, a young man, M. Contremoulins, of the Laboratory of Micro-Photography, under the direction of M. Renny, member of the Faculty of Medicine, in Paris, came to the fore and quieted the fears of scientists and surgeons by inventing an apparatus called "le chercheur de projectiles," or "searcher for projectiles," which he claims is capable of revealing with the absolute precision of a "demi-millimeter" the exact location of a ball in the brain.

This apparatus, which only left the hands of its inventor a few days ago, has a history connected with it which is worth relating. Its invention not only does honor to the knowledge and tenacity of MM. Contremoulins and Renny, but it also proves that there are still some persons in France interested enough in scientific research to encourage them and to help financially when such assistance has been denied by the state.

The Faculty of Medicine in Paris was not in possession of the necessary funds for starting and maintaining a radiograph laboratory, and yet such a laboratory exists and owes its existence to MM. Contremoulins and Renny. The former, fascinated by Roentgen's discovery, and foreseeing its innumerable applications to surgery, procured, at his own expense, with the assistance of M. Renny, the indispensable apparatus for such a laboratory.



THE PRODUCTION OF RADIOGRAPHIC NEGATIVES.

He constructed at his own expense an apparatus still embryonic, but which, however, indicated and discovered with a perfect precision any projectile introduced into a brain.

This experiment, first satisfactorily performed some six months ago, was most eulogistically spoken of by Prof. Marey, in a lecture at the Academy of Medicine.

It now became a question of constructing the apparatus of which M. Contremoulins had made the model. This called for an outlay of 2,500 francs. This amount not forthcoming, the construction of this useful apparatus would be retarded and even prevented. M. Marey made this "sad revelation," as he called it, publicly, expressing the hope that in showing the penury to which science was reduced some generous patron might be induced to come foward and donate the necessary sum.

This appeal was inserted in Le Temps, and the next day a M. Dessaux sent the necessary 2,500 francs to M. Marey. M. Contremoulins was then in a position to push the work ahead on his apparatus, which was delivered to him in its perfected state the first of last month.

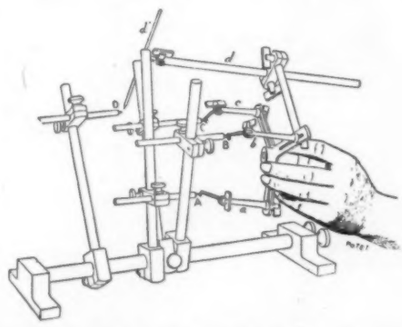
M. Contremoulins' "searcher for projectiles" has made good its promises. It has already searched for and found the balls which two unfortunates had lodged in their brains. The operation of extracting them was performed recently by M. Renny in a remarkably skillful manner. The patients, who have recovered very rapidly, left the hospital the past week. The success of the operation was proclaimed amid great applause on Monday, December 6, at the Academy of Sciences, and on Tuesday, December 7, at the Academy of Medicine.

The principle of the method is as follows: With the aid of two radiographic proofs, obtained at different times, of a head, inside of which is seen a ball, the center of this ball is determined by a geometrical construction, and by its relation to three fixed points or guiding marks traced on the face of the wounded man.

Then, by means of small movable arms jutting outward, the ends of which come together, the relative position of the three fixed points and the ball are determined. The four extremities of these movable arms are then attached to a compass. This compass, thus set, is placed upon the head of the patient and adjusted to the three guide marks on the patient's face; the extremities of the fourth arm, if the head has been perforated, will coincide exactly with the center of the ball. It is then only necessary for the purpose of extraction to follow the direction indicated by the fourth arm and to penetrate to the depth indicated by the length of this arm.

To obtain two radiographic proofs which will permit of the exact locating of the center of the ball calls for the absolute immobility of the Crookes tubes in connection with the sensitive plates. With this end in view, two small, thin pieces of wood are sealed in plaster and placed on the upper part of the patient's head, and to these is screwed a metal plate.

This plate supports on one side of the head a shutter, in which is successively disposed two photographic plates, and on the other side two improved Crookes tubes, joined in such a manner as to allow them to be moved in any desired position.



REGULATION OF THE OPERATING COMPASS UPON THE COMPASS DIAGRAM.

Besides, this metal plate has on its outer surface three jointed arms, whose extremities are placed on the three guide marks on the patient's face; these marks are, generally, one on the forehead and two on the cheeks. This primary apparatus being thus disposed (and called the "searching apparatus"), a photographic plate is slid into the shutter, and is worked by sending a current from a very powerful Ruhmkorff coil, giving a thirty-eight centimeter spark through one of the Crookes tubes.

At the end of a quarter of an hour a radiograph is obtained. After this plate is developed, the shadow of the ball will be distinctly seen in the interior of the brain. The operation is renewed by means of a second plate and a second Crookes tube. In this way two pictures of the same ball are obtained, occupying different positions, for the reason that the luminous focus of the two Crookes tubes occupies different positions in relation to the ball and the shutter inclosing the plates.

The metal plate is then removed from the patient's head without disturbing the different parts of the apparatus. If we now prolong the focus of each of the Crookes tubes and the center of the shadow of the ball on the corresponding radiographic plates by means of threads, we reconstruct the path of the luminous rays. The point at which these threads cross is the point at which the luminous rays had but a moment before met. This, then, is the center of the ball, and the point at which the threads intersect each other gives the exact position of the ball in the brain at the moment the radiograph was taken. This apparatus M. Contremoulins calls "the compas schema," and by it regulates the compass of operation.

The obtaining of the radiographic negatives that permit of determining the center of the ball necessitates an absolute immobility of the Crookes tube with respect to the sensitized plates. To this effect, two pieces of wood, R R', to which is screwed a metallic frame, P, are fixed to the head of the patient with plaster. This frame, on one side of the head, supports a frame in which are successively arranged two photographic plates, S, and, on the other side, two improved Crookes tubes, T and T', so jointed as to permit of giving every position necessary. Besides the frame, P, carries at the front part three jointed rods, the extremities of which are applied to three points of the patient's face, which are usually selected as follows: One upon the forehead, M, and the two others upon the cheek bones, NO.

This first apparatus, called the "research apparatus," being thus arranged, a photographic plate is placed in the frame, and one of the Crookes tubes, T, is actuated by passing through it a current from a very powerful Ruhmkorff coil, giving a 38 cm. spark. At the end of a quarter of an hour the radiograph is obtained. Then the plate is developed, and the image of the projectile is seen detaching itself from the interior of the image of the skull. The operation is renewed with a second plate and the second Crookes tube. There are thus obtained two images in which the projectile does not occupy the same place, since the luminous foci of the two Crookes tubes occupied different positions with respect to the ball and to the frame inclosing the plates.

The frame, P, is removed without touching the different parts of the apparatus. If we connect by wires the focus of each of the Crookes tubes with the center of the image of the ball upon the corresponding radiographic negative, we shall reconstruct the passage of the luminous rays. The point at which these wires cross each other is the one at which the luminous rays were just met with. It is therefore the center of the ball; and the point of intersection of the wires gives the position that the projectile occupied in the skull at the moment at which it was radiographed. The three rods, whose extremities, M N O, correspond to the three register marks of the face, remaining in place, the crossing point of the wires gives the position of the center of the ball with respect to the three register marks. The whole of this permits of the construction of a diagram practically fixing the relative positions of the projectile and the three register marks.

Near the apparatus above described is placed a small platform on which slide four columns carrying four jointed rods. It suffices to bring the extremities of these rods in contact with the crossing point of the wires and the register points, M N O, in order to transfer to D the center of the ball and to A B C the register points, in their relative positions. This is what M. Contremoulins calls the compass diagram.

Henceforward the primitive apparatus will be useless. The diagram will advantageously replace it, since it is possible to pack it and carry it to a hospital or to the home of the patient.

The "compass operation" is, properly speaking, the true "projectile seeker." This compass consists of four branches, three of which, a b c, are so fixed and arranged as to apply themselves by their extremity to the points, A B C, of the compass diagram, which correspond to the register points of the patient's face. The fourth branch, d, which is movable in all directions, carries a guide through which slides a blunt needle, d'. This branch is fixed in the proper position and the needle is made to slide until it comes into contact with the point, D, of the rod of the compass diagram representing the center of the projectile; and by means of a screw ring one fixes upon the needle the point at which it stops in the guide when its extremity is in contact with the point, D.

The operating compass is regulated, and all that remains to be done is to transfer it to the patient in order that the surgeon, guided by the needle, may begin his work. In order to effect this transfer, the blunt needle is removed from its guide. As shown in the figure, the extremities of the three branches, a, b, c, are applied to the three register marks tattooed in the patient's skin. Then it suffices to slide the needle in its guide in order to obtain a precise indication of the direction in which the ball is to be found. The depth is indicated by the distance between the guide and the ring screwed upon the needle.

As the branch, d, may be placed in any position at will, it suffices to regulate the compass differently in order to obtain a different direction of the needle. Thus the least perilous, surest and shortest way may be chosen. Whatever be the way selected, the needle will always indicate the exact direction and depth of the projectile. In the course of the operation, the needle will constantly indicate, through the distance of the ring in the slide, the precise distance at which the operator is from the projectile. Finally, when the ring is in contact with the slide, the projectile will be under the surgeon's instrument. If, instead of one ball, it is necessary to extract several, or several fragments, the method may be applied with the same sureness.

For our engravings we are indebted to L'Illustration.

To Make Labels Adhere on Tin.—Labels will adhere perfectly to tin, no matter what paste is used, if you wipe the entire surface of the tin with merely a suspicion of hydrochloric acid. The reason is that all tin is dressed in oil, and hydrochloric acid removes that, just as it does for the solderer.

PINEAPPLE FIBER.

INDICATIONS are that the fiber of the pineapple leaf will eventually take prominent place among the constituents of textile fabrics.

Both the wild and cultivated pineapple yield fiber which, when spun, surpasses in strength, fineness and luster those obtained from flax; can be employed as a substitute for silk, and as a material for mixing with wool or cotton. Useful for cordage, textile fabrics, sewing silk or twist, laces, etc. In China, fabrics for clothing for agriculturists. In request in India as material for stringing necklaces. Produces the celebrated pina cloth of the Philippine Islands. It is remarkably durable, and unaffected by immersion in water; and is white, soft, silky, flexible, and long in staple. Samples cleaned, without washing, in the government experiments in Florida, 1892, when twisted to the size of binding twine, showed a breakage strain of 150 pounds. Dr. Taylor subdivided a specimen of this fiber to one ten-thousandth of an inch.

Pineapple culture, for its fruit, in Florida, is a comparatively recent industry, the first plantings having been made on the keys about 1886, though the first plantation of commercial importance was not established until five years later, on the Indian River. The value of the fiber has long been known, however, and in 1891 the fiber expert of the United States Department of Agriculture began a series of investigations into the practicability of utilizing the Florida leaves for fiber after the fruit had been gathered, as their utilization would give to the United States a new industry. In the experiments of 1892 it was shown that the yield of fiber from freshly cut pineapple leaves ranges from 45 to 60 pounds per ton of 2,240 pounds of leaves. An important point to be noted is the fact that selected leaves as to size do not give as high a yield of fiber as average leaves. Lot No. 1 was 820 pounds of average and 202 pounds of leaves. While the total, 1,022 pounds of leaves, gave 25 pounds of fiber, against a yield of four pounds from 202 pounds of selected leaves. Reduced to equivalents, the average leaves yielded at the rate of 57½ pounds to the ton, while the selected leaves yielded less than 44½ pounds of fiber to the ton.

Lot No. 5 was from Fuzzard's plantation, near the Perrine grant, 1,000 pounds of leaves, tips cut off. The leaves averaged 10 to the pound. Dry fiber from this 1,000 pounds weighed 18 pounds 2 ounces, or a little over 40 pounds to the ton of leaves. It should also be noted that there was an excessive waste of fiber in the process of cleaning.

Special Agent Monroe, who attended to the details of the experimental work of 1892 in Florida, stated that the practice has been to allow the leaves to decay under the plant and afford possible nourishment to the young suckers. The general opinion on this point is in favor of cutting the leaves, but experiments covering several seasons will be necessary to decide this point. Owing to the practice on the keys of planting very close, it was found that a large proportion of the leaves were injured by chafing one on another, and also from being crushed under foot in weeding and cutting the fruit. This condition seems to be almost entirely obviated by spacing the plants at least two feet, as has been done on the mainland. Another defect was found in the withered condition of several inches of the tip or end, not noticeable in the younger leaves. This, however, may have been due to the excessive drought of the season. It does not occasion much loss of fiber, but adds to the cost of extraction, the decayed parts having to be cut off. The approximate acreage in pineapples in 1892 on keys Metacomba, Largo and Elliott's was 930, and the number of apples shipped (1892) about 1,916,400, which did not include many thousands marketed after the close of the season.

The average yield of good leaves from the Red Spanish was about 10 out of the average 25 of each plant, and the weight one pound, making the total for fruited plants, in round numbers, 958 tons. Adding the leaves to be secured after the close of the season and from abandoned fields, the quantity might be raised to 1,000 or 1,100 tons. This refers, of course, to extreme southern Florida, no account having been taken of the large acreage on Indian River and elsewhere.

As to the value of the fiber, a London quotation for a lot of well cleaned from an Asiatic source was $150 per ton. There is no doubt that if the fiber could be produced in quantity at an economical cost, manufacturers would soon find a use for it and would know what price they could afford to pay for it. The market price would then be fixed by the demand and supply. The machine question enters largely into the problem, however, and as the leaves are small, a quantity would need to be cleaned at one feeding of the machine to make it pay. Estimating ten leaves to the pound, there would be over 22,000 leaves to the ton, which, as we have seen, would produce from 50 to 60 pounds of fiber.

The machine used in the department experiments produced a fine product, but in too small quantity to be employed commercially. There is no doubt that a modified Sisal hemp machine (automatic) would do the work, although a machine has recently been constructed for a small leaved plant that may be adopted to use in extracting the fiber.

The Chinese extract the fiber by hand. The first step is the removal of the fleshy sides of the leaf. A man sitting astride a narrow stool extends on it in front of him a single leaf, one end of which is held beneath him. He then, with a kind of two handled bamboo plane, removes the succulent matter. Another man receives the leaves as they are planed, and with his thumb nail loosens the fibers about the middle of the leaf, gathers them in his hand, and by one effort detaches them from the outer skin. The fibers are next steeped in water, washed and laid out to dry and bleached on rude frames of split bamboo. The processes of steeping, washing and exposing to the sun are repeated until the fibers are considered properly bleached. In the Philippines the blunt end of a potsherd is used, and the fiber is carefully combed and sorted into four classes.

The Chinese fiber is manufactured into a strong, coarse fabric resembling the coarser kinds of grass cloth. In Formosa its chief use is for the inner garments of the agricultural class. The fabric is called Huang-li-Pu. Pina is considered to be more delicate in texture than any other known to the vegetable kingdom. It is woven from the untwisted fibers of the pineapple leaf after reducing them to extreme fineness and after the ends have been glued together to form a continuous thread. There is another delicate fabric, used for ladies' dresses, which is said to be manufactured from pineapple fiber woven with silk, the latter forming lustrous stripes in soft colors or shades.

The pineapple cloth of the Philippines is produced by the common pineapple also, i. e., Ananas satira. The plants have become almost wild in Singapore and the Philippines, with leaves five to six feet long. The fruit is small, but the leaves appear to yield better fiber than the cultivated plants.—From Catalogue of Useful Fiber Plants of the World, by United States Department of Agriculture.

REPEATING BELLS IN CLOCKS.

IT may prove interesting and useful at a given moment to have the striking train of a clock repeat the hour at one's will. We shall describe a simple arrangement devised to this effect by M. F. Derry. This system, which possesses no complicated mechanism, may be applied to any kind of a clock and be actuated at a distance by means of a pneumatic or electric button.

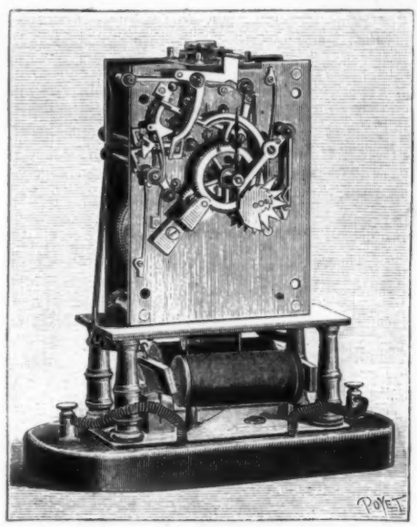


FIG. 1.—A REPEATING CLOCK.

Let us in the first place give a brief description of the classic system of starting gear of a rack train that strikes the hours and half hours. At rest, the different parts are in the position shown in the diagram (Fig. 2), and the wheelwork is arrested by a snug fixed to the piece, H. Upon the piece, A, are fixed two pins, A' and A'', which are so arranged that after lifting the detent, G, the latter may drop just at the moment at which the hour hand is upon 12 or 6. As soon as it is raised, the detent, G, carries along with it the stop, H. At this moment there occurs the first start of the wheelwork, which is almost immediately arrested by a

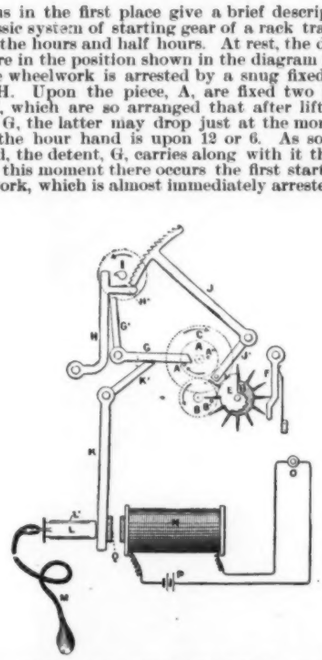


FIG. 2.—DIAGRAM EXPLANATORY OF THE STARTING ARRANGEMENT OF A STRIKING TRAIN.

snug fixed to the detent, G. The object of such start is to render the wheelwork dependent upon the detent, the wheelwork not being set free until the moment at which the detent falls. The pieces, G H, continuing to rise (carried along by the pin, A), the rack, I, soon becomes free, and, actuated by a spring, falls until its arm, J', abuts against the snail, E, leaving beneath the arm, H', a number of teeth exactly corresponding to the indication of the hour given by the small hand.

The snail, E, and the star wheel, D, are interdependent, and the latter, being every hour carried along by the pin, B, advances one tooth and thus permits the rack, J, to make a longer travel in measure as 12 o'clock is approached. The pieces remain in the position just indicated until, the long hand having reached 12, the detent, G, falls and sets the wheelwork free. The piece, H, remains raised (the arm, H', engaging with the teeth of the rack) and permits the wheelwork to continue its revolution. The rack is raised tooth by tooth by the click, I, fixed upon the second wheel. To every revolution of the latter there corresponds one blow struck upon the bell of the clock. As soon as the rack is lifted high enough, the piece, H, falls to its position of arrest in stopping the wheelwork. In order to cause one stroke only to be given at the half hour, the pin, A', is fixed upon a smaller diameter, so as to raise the pieces, G and H, sufficiently to permit of the first start, but not enough to cause the rack to fall. The wheelwork is therefore arrested as soon as the second wheel has made one revolution.

In order to cause the clock to strike at every quarter, the principle is the same as for the hours.

From what precedes it will be seen that in order to free the striking train, it is necessary to raise the piece, H, sufficiently to permit the rack, J, to fall. This is effected by M. Derry's arrangement in a very simple manner. K is a lever, of which the upper arm, K', engages with the detent, G, the lower arm serving for the maneuvering. If the lower arm be provided with an armature, Q, the latter will be attracted by the electromagnet, N, as soon as the circuit of the battery, P, is closed at any point whatever by means of a temporary contact.

The result will be the same if, instead of the electric system, the pneumatic be employed. The arrangement in this case is of still greater simplicity, because it necessitates no installation, either of a battery or of wiring for leading a current from a distributing line.

Two tubes, L and L', one entering the other, are closed at their extremities. One of these tubes is stationary and receives the extremity of a small rubber tube of sufficient length to answer the requirements that one has in view. The other tube is movable and abuts against the lower arm of the lever. Upon squeezing a bulb fixed to the free extremity of the rubber tube a pressure of air will be brought about in the tube, L, sufficient to act upon the tube, L', and, at the same time, upon the lever, K.

Fig. 1 represents what is called a traveling clock, the case and dial of which have been removed.

For the sake of demonstration, both the electric and pneumatic systems above described have been applied to this clock, which repeats the hour at every quarter. —La Nature.

TESTING A BOILER TO DESTRUCTION.

AT the recent convention of the American Boiler Manufacturers' Association, held in Philadelphia, John O'Brien described, says the Mining and Scientific Press, the testing of a boiler to destruction. The boiler was made and the tests were instituted and carried through by the O'Brien Company. The boiler was 60 inches in diameter by 12 feet in length. The shell was ⅜ inch steel of 60,000 pounds tensile strength. The heads were of ¾-inch steel. There were fifty-six 3½-inch tubes. The front head was braced with five ⅛ by 4-inch flat stays, doubled. The boiler was made of two rings, designated A and B. The joint of ring A was a butt joint with inside and outside straps. The joint of B was a triple rivet lap joint, with an inside strap extending 2½ inches each side of the ends of lapped plates. The circular seams were single riveted.

The results of the tests, in which hydraulic pressure was employed, are indicated by the following record:

TEST NO. 1.—MARCH 29, 1897.

Ring B.

	Inches.
At 300 pounds pressure ring expanded	1⅜
" 450 " " " "	2⅝
" 750 " " " "	3½

Ring A.

At 300 pounds pressure ring expanded	2⅝
" 450 " " " "	3½
" 750 " " " "	5

TEST NO. 2.—APRIL 4, 1897.

Ring B.

At 625 pounds pressure ring expanded	3⅞
Increase in expansion over test No. 1	⅝

Ring A.

At 625 pounds pressure ring expanded	5¾
Increase in expansion over test No. 1	⅜

TEST NO. 3.—APRIL 5, 1897.

Ring B.

At 350 pounds pressure ring expanded	4⅛
" 400 " " " "	4⅛
" 625 " " " "	4⅞
Increase in expansion over test No. 2	⅛
Total expansion for the three tests	4⅛

Ring A.

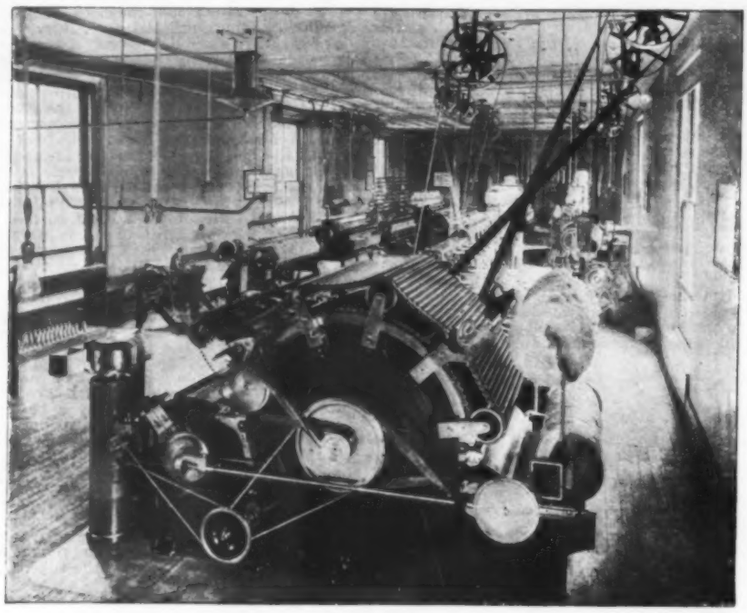
At 350 pounds pressure ring expanded	5½
" 400 " " " "	5½
After 400 pounds pressure no perceptible change occurred.	
Increase in expansion over test No. 2	⅛
Total expansion for the three tests	5½

At 900 pounds pressure the boiler ruptured on the side, horizontally in the second ring about 18 inches above the riveted joint, in the whole plate, the rupture being about a foot long.

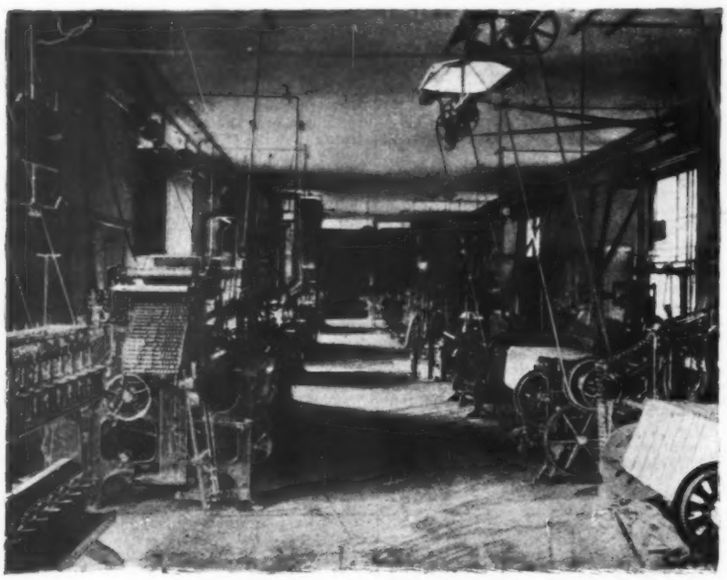
The putting of new wine into old bottles is by no means an uncommon occurrence in these degenerate days, says the Pottery Gazette. An ingenious inventor, however, has devised a bottle which cannot be refilled without detection. It has a visible compartment, in which is placed blotting paper or some other substance which will be defaced by wetting, and is so constructed that, in pouring into it, some of the liquid must enter the compartment.

PHILADELPHIA TEXTILE SCHOOL.

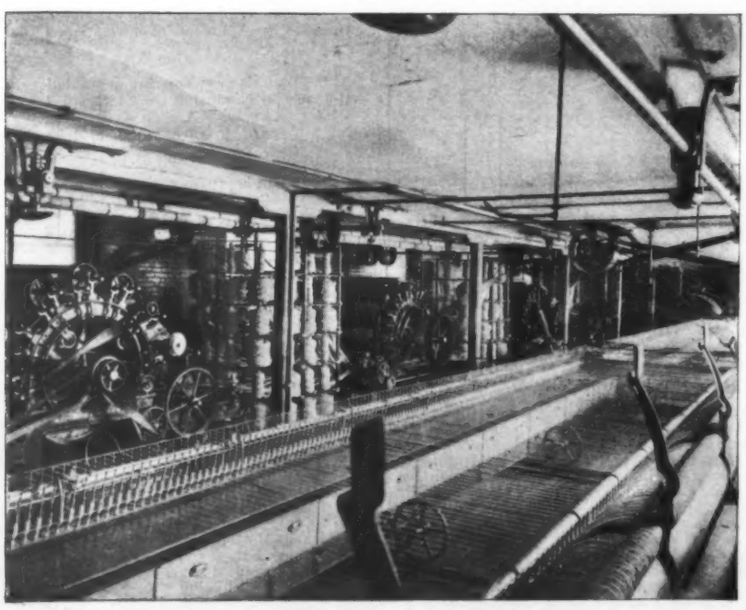
WE take pleasure in publishing in the present issue a few views of the Philadelphia Textile School, an institution which is destined to exercise a powerful influence in the development of American manufactures. The question of technical education has come to be regarded as of the very first importance in the industries of this country, and it may be safely stated that on nothing else does their future welfare depend quite as directly as on the promotion of such good work as that of which the Philadelphia Textile School is the leader in America. The eagerness with which the establishment of similar schools is discussed throughout the South and the recent establishment of a school in Massachusetts furnish sufficient proof of the fact that this principle is now recognized, and the work of educational organization and adjustment which it implies is sure to go rapidly forward after this.



A VIEW IN THE COTTON CARDING AND SPINNING ROOM OF THE PHILADELPHIA TEXTILE SCHOOL.



ONE OF THE POWER WEAVE ROOMS.



THE WOOL CARDING AND SPINNING ROOM.

The school, which is a part of the Pennsylvania Museum and School of Industrial Art, is simply the embodiment of the idea that technical education, to be effective, must be definite and practical in its relation to the industries which it is intended to affect. It is not a school for the teaching of the general principles of mechanics or of anything else. Its laboratories are practical workshops, or rather mills, in which the greatest variety of production is carried on, and may be studied and practiced almost as well as in establishments devoted to any one line of manufacture and managed on a commercial basis. It is well known that while there are excellent schools of this kind in Europe, there are very few in America. We have illustrated the Lowell Textile School in the SCIENTIFIC AMERICAN for October 16, 1897. For example, the very excellent school at Crefeld, which is always pointed to as probably the best school of its kind in Europe, while well equipped for the study of silk, is by no means fitted to teach the principles that relate to cotton manufacture. The school in Manchester, England, has excellent facilities for teaching the manipulation of cotton, but is meagerly provided with either appliances or courses for the instruction of whatever relates to wool or silk.

The Philadelphia Textile School, enjoying as it does the advantage of being located in a city whose textile industries are not only enormously developed, but immensely varied, and having students interested in the greatest variety of work, has the opportunity of illustrating its teaching outside of the class room by means of visits to the industrial establishments of almost every conceivable form of textile manufacture in the neighborhood. The managers of the institution have always aimed to make the most of these advantages, and alike in the selection of the equipment and of the instructors, they have aimed to give the utmost possible breadth to its work.

The school is magnificently housed in buildings that stretch the entire length of a Philadelphia square in the very heart of the city, and is furnished with every kind of material which is requisite to the treatment of fibers, from the raw material to the finished fabric; including chemical laboratories, a dye house, carding and spinning rooms for wool and cotton, as well as appliances for the reeling of silk, etc.

The corner stone of its system, so far as the methods of instruction are concerned, is insistence upon the thoroughness with which each student is expected to perform the practical work instead of having all the hard work done for him, as is almost universally the case in European schools of a similar character. This is a thing which is at once recognized and commented upon by visitors and students who have attended the schools in Europe, of which there have been a great many registered in the Philadelphia Textile School. They unhesitatingly testify to the superiority of the American method and bear testimony to the fact that it is in the main a great mistake to send boys to Europe for an education of which they are expected to apply the results in America.

In the Philadelphia school every boy is expected to dye his own yarn, make his own warp, punch his own cards, and weave his own goods, and for this purpose a loom is assigned to him and he alone is responsible for what it contains and what it produces. This is probably not the case in any school in Europe, or any other in America, where mechanical appliances are for the most part used more for demonstration of principles and theories than as a means of manual as well as mental development. The importance of this principle is hardly to be overestimated; if the new idea in education means anything, it means that the pupil learns by doing. Laboratory methods are not merely demonstrations. If they were, the lecturer with a perfectly equipped desk between him and his pupils would furnish the ideal of teaching. The Philadelphia school carries the laboratory idea further than any institution in our midst, and the boys actually do the work, thereby being educated and developed. Not the least important thing that is to be said about this new education is that it has caused a class of men to take a deep interest in educational matters who used to think very little about them. Delegation after delegation of business men have visited the Philadelphia Textile School and have borne testimony to the importance of the work in which it is engaged.

The New England Cotton Manufacturers' Association, a body which had never held a meeting outside of New England, with the exception of the one held during the Atlanta Exposition, held its last convention in Philadelphia, in order that its members might inspect the work of the Philadelphia Textile School.

The National Association of Manufacturers also held its annual convention in Philadelphia in June, 1897, and devoted a portion of its time to the inspection of the school, when President McKinley visited the school and spoke in the highest terms of the work which it was doing and the important influence which it was sure to exercise on the industrial development of the country.

The interest manifested by the National Association of Manufacturers is of exceptional importance from the fact that the present president, Mr. Theodore C. Search, is the man to whom the school really owes its creation. Early in the eighties, Mr. Search, through his own initiative, and with only a meager support, established the school in the conviction that it was the one thing necessary for American textile progress, and almost unaided for many years he carried on the noble work of building up the institution which enjoys so great a reputation to-day.

FIRST PEANUT OIL FACTORY IN THE UNITED STATES.

THE first peanut oil factory in the United States will be established in Norfolk, Va., at an early date. The oil is highly valued in Europe, as it is stated that fully $5,000,000 worth of peanuts are taken into Marseilles annually for the manufacture of oil, which is used in

toilet soaps and for other purposes. The peanut flour is quite extensively used in Europe and made into bread, cakes, biscuits, etc. It is one of the favorite articles of food, according to consular reports, in hospitals in Germany. The capital stock of the peanut company is $60,000, and it will operate under the patents of Mr. Weatherly, which cover the machinery and methods of decorticating the kernel of the inner skin. According to the estimates made, says the Atlanta Constitution, the cost of a plant for treating five tons of peanuts daily is as follows: Machinery, $9,000; building, $6,000; while the expenditures, including labor, insurance and taxes, amount to $337 per day. In a prospectus issued by the company, it is calculated that the receipts from five tons of peanuts will amount to 235 gallons of refined oil at $1 per gallon, 175 gallons of crude oil at 50 cents, 3,680 pounds of flour and meal at 2 cents and 3,680 pounds of stock feed at 60 cents per 100 pounds, making the total gross receipts $415.90 per day, which, it is estimated, would give a yearly profit on a five ton factory of $19,725.—National Provisioner.

ENLARGEMENT OF THE PORT OF MARSEILLES.

A DECREE of July 17, 1893, declared of public utility the work to be executed for the enlargement of the port of Marseilles through the construction of a new basin to the north of what is called the National. As this maritime work has just been begun, we think that we shall interest our readers in making known to them the reasons that prompted it and the conditions under which it is proceeding.

Despite the great injury to the exterior commerce of France caused by the successive increases in customs duties, the increase of navigation in the port of Marseilles rendered a new extension of the basins necessary. In fact, while in 1878 the total figure of the tonnage gage of the vessels that entered and cleared was 5,400,000, it rose in 1889 to 9,518,500, and in 1891 to 10,611,000, with a drop to 9,453,000 in 1893, followed in 1896 by a rise of 10,548,000 tons divided among 16,290 ships.

Unfortunately, it must be considered that such increase is due especially to foreign flags and that it is very slight as compared with the progression followed by the large competing ports.

On comparing the effective movement per linear foot of wharf (that is to say, the quotient of the tonnage gage by the utilizable length of the wharves) with the figure of 500 tons considered as the limit beyond which maritime commerce ceases to have the facilities of which there is need, we clearly recognize the inadequacy of the present installations of the port of Marseilles, since the normal coefficient was doubled in 1896. The wharves that are particularly needed are such as may be accessible to ships of heavy draught.

There is no wharf that can receive vessels drawing more than 25 feet of water, and these have to operate in the middle of the basins. As the Suez Canal has been deepened to 28 feet, it became urgent to provide for the landing of vessels of such load water line at wharves. The work of deepening the National Basins along the wharves of its two inner moles is now in progress.

The creation of a new basin was further prompted by the removal toward the north of the New Abattoirs, in the proximity of which it appeared expedient to establish a mole for the landing of cattle, of which 20,000 often arrive in a single day. Finally, a special floating dock for the discharge of petroleum has long been demanded, since it is of the utmost necessity, in order to prevent the spread of a fire in the port and to isolate the petroleum yard, the entrance to which will be closed by a gate above the level of the sea.

The arrangement of the places, the progress made up to the present in the extension of the port of Marseilles toward the north and also the prospective connection of the junction canal with the Rhone, necessitated the general plan of the new basin, consisting in prolonging the jetty (which is already 2½ miles in length) in a straight line to abreast of Cape Janet and in constructing the new maritime installations between it and the shore. The new basin, called the "Pinède," after the name of the cape in front of which it will extend, will measure 2,100 feet in length by 1,640 in width. It will be divided into three secondary basins by two moles and be bounded on the north by the mole of Madrague, situated in front of the village of that name, which has become a faubourg of Marseilles.

The Pinède basin will increase the length of the utilizable wharves in the interior of the port by 9,050 feet, a length which now reaches the total figure of 43,295 feet for a surface of water of about 1,300,000 square yards. The depth at the foot of the new wharves will be everywhere 28 feet. Moreover, the alignment of the shore wharf prolonged beyond the petroleum yard as far as to Cape Janet will unite in Madrague Bay a surface of about 120,000 square yards, which will form an excellent docking for the numerous ships, lighters, etc., that encumber the different basins.

The plans (Figs. 2 and 3) of the port of Marseilles and of the new basin that is to be opened to the north will permit of obtaining an accurate idea of the work that is now in progress. All the plans and specifications having been definitely drawn and the arrangements made by the maritime engineering service, which is under the direction of M. Guerard, the work was begun and then suspended and last year was made the object of a new adjudication, comprising the construction of wharf walls and the deepening of the basin. Out of the four houses that put in bids, that of Zschokke, of Switzerland, which has done much work in France, obtained the contract at five million francs, the work to be completed in five years.

At the beginning of June last, work was begun in front of Cape Pinède by the construction of a wharf wall, which will form the north side of mole E.

Two large compressed air caissons of an improved type were submerged. In each of these 20 laborers work at a time, at a depth which is 26 feet at present, but which will be increased later on, since the walls of the batterdeaux will have to be founded at 40 feet below low tide. Four other caissons will successively be put in service in measure as they are needed.

The arrangement and installation of one of these caissons present considerable interest and are worthy of description. The caisson consists of a large rectangular iron plate box 65 feet in length, 21 feet in width and 9 feet in height. There is no floor, but, on the contrary, the ceiling, which is situated at a height of 6 feet, is of double thickness and strengthened by very strong iron girders. The walls of this huge caisson rest through their sharp edge upon the rocks of the uneven bottom of the sea, and the working chamber has a capacity of 2,800 cubic meters.

The caisson is kept perfectly tight by means of compressed air. The high pressure of the air prevents the ingress of water from below, and on another hand, the ballast deposited upon the top and kept in place by the rim of the caisson prevents the latter from rising.

Communication between the exterior and the interior of the caisson is assured by three cylinders wider than the diameter of the human body and of variable height and that emerge above the level of the sea, where each terminates in an air lock. One of these locks serves for the workmen and the two others for the materials. It is through the lock provided for them that the laborers enter and make their exit by means of a double door which allows of access to the cylinder, in which there is a small iron ladder that leads to the working chamber. The locks are lighted, and those for materials, which are provided with windlasses, have automatic doors. Access to them is had by means of lighters. The section of one of these caissons that we give in Fig. 1 very well shows the general plan.

The machinery of the working station, installed in the open air upon a terrace in the vicinity, produces, with 80 h. p., the compressed air necessary, as well as the electricity that supplies the ten incandescent lamps of each submerged working chamber. Two gangs of laborers continually replace one another in the caissons in order that the excavating and the laying of the masonry may never be interrupted, day or night.

Finally, when it becomes necessary to change the location of a caisson, lighters lashed together and provided with towing apparatus make fast to it and move it to its new position.

It will be seen that this is an important work that is to be accomplished in the port of Marseilles. According to the law of 1893, the total cost is estimated at twenty million francs, a third of which is furnished by the Chamber of Commerce, while the remainder will have to be provided for in the annual budgets of the Minister of Public Works. In order to assure the service of the loan that the contribution of the Chamber of Commerce has exacted, a toll of five centimes per ton is collected at the entrance upon merchandise coming by sea, as well as upon the heads of cattle.

It must not be supposed that the government shows a particular generosity toward the first port of France. In fact, from 1814 to 1892, while eighty-eight million francs were spent for Havre and forty-two for Dunkirk out of the funds of the treasury, only seventy-six millions have been appropriated for Marseilles. And yet the annual amount of custom duties collected at this port alone reaches nearly this figure.—La Nature.

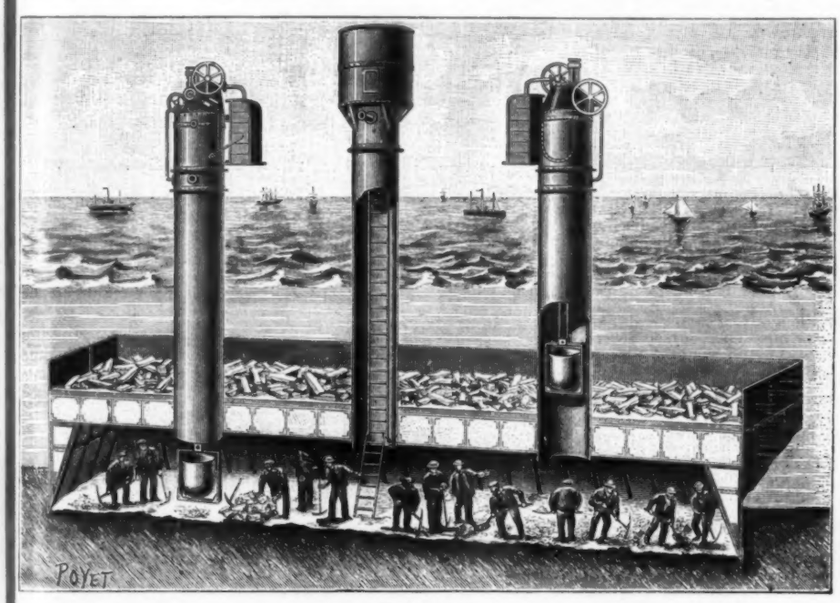


FIG. 1.—SECTION OF ONE OF THE CAISSONS USED IN THE WORK OF ENLARGING THE PORT OF MARSEILLES.

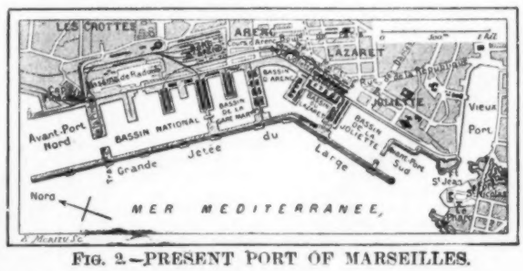


FIG. 2.—PRESENT PORT OF MARSEILLES.

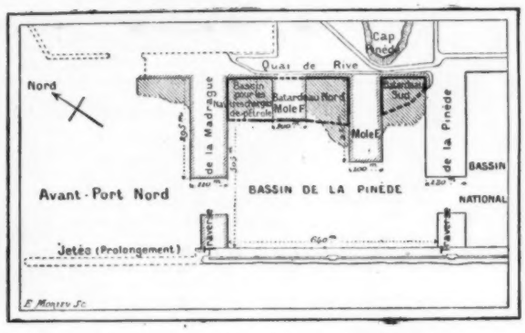


FIG. 3.—NEW BASIN OF MARSEILLES.

THE COMPARATIVE ADVANTAGES AND DISADVANTAGES OF STEAM, COMPRESSED AIR AND ELECTRICITY FOR POWER PURPOSES IN COAL WORKING, WITH SPECIAL REFERENCE TO COAL CUTTING AND HAULAGE.

(The Iron and Coal Trades Review Prize Essay.)

By G. E. J. MCMURTRIE, A.M. Inst. C.E., Cinderford.

IN considering the comparative advantages and disadvantages of steam, compressed air and electricity for power purposes, with special reference to coal cutting and haulage, the writer is much struck by the careful manner in which the efficiency of most, if not all, recent important electric installations has been tested. The same remark may be applied to the more recent extensions of the use of compressed air at Paris and Birmingham; whether the efficiencies of the large air compressing plants still being put down at collieries, especially in South Wales, are noted with equal care, is probably open to question.

Mr. Nicholas Wood found, as the result of experiments, that, where no special source of loss existed, underground hauling engines can realize an efficient performance of 40 to 50 per cent. of the pressure of the steam upon the piston, and with the improved engines of the present day the value may be safely increased to 50 to 60 per cent. (estimated) in coal conveyed. Few recent records can be found of steam haulage plants, although doubtless many are still being put down.

The efficiency of such a plant is seldom recorded. If taken, the actual cost of haulage is given in cost per ton per mile, the principal costs being grouped under the heads of ropes or chains, maintaining plant, coal and labor. The first cost comprises that of wagon way, plant and original cost of boilers, engines, etc., the comparative first cost per mile of wagon way being thus obtained.

The writer would have expected that those in favor of the older systems of steam and compressed air haulage, in the face of the keen competition of electricity, would have gone to considerable trouble to put forward confuting figures; yet, when this question has been brought before mining institutes, general statements alone have been produced on their behalf, and exact figures, which have been almost ostentatiously displayed by the advocates of their powerful rival, have been withheld.

This has greatly added to the writer's difficulties, as, whatever may have been his predilections, actual records of hard facts can alone carry weight and be considered.

The principal purposes for which power will be required at collieries are winding, hauling, pumping and coal cutting, and hitherto steam alone has been

used in this country for the first purpose, although a large winding plant of 300 horse power has, the author understands, been dispatched to and erected at the De Beers mines in South Africa, and is in successful work.

Possibly, too, instances could be found of small installations in England for raising material from shallow staple pits.

But here the record of electric winding has ended, although able papers have been written advocating the entire use of electricity as the motive power of a colliery largely on account of the greater efficiency that would be obtained from one central plant, instead of, as now, a number of scattered plants, with steam supplied to them in a very wasteful manner, and the admittedly great convenience of electric cables for conveying the motive power to the motors. If this were done the central plant should consist of a number of smaller engines, just as with dynamos at a central lighting station, which could be put on or off as the load came on or off; otherwise, in the event of the central engine breaking down, everything would be at a standstill. Unless there were a duplicate plant, which would entail large additional capital expenditure, no one could ascend or descend the shaft till the breakage was repaired, and the stoppage of the fan would probably mean serious consequences.

While such a scheme would undoubtedly be economical in motive power, and probably in first cost, it can hardly be considered within the range of everyday practice.

As yet the winding engine, placed close to the boiler, is universally driven by steam, and in spite of the wasteful character which is due to the varying loads, and which necessitates at its maximum load (probably) four times the quantity of steam that its minimum load requires, i. e., when reaching top, it is likely to remain so, unless, as is probable, some such arrangement of electric motors be tried as that suggested. In that case, as the power required by fan, pump and haulage (supposing endless rope to be the system) is pretty regular, the extra power beyond the average required by the winding engine at its maximum can be got from a motor that can be thrown in when required and cut out as soon as done with. Thus used, no waste of power would take place, and there would be sufficient to lift the maximum load in place of steam being kept on the engine all the time, as is generally the case, except when the addition of the cutoff, regulated by automatic expansion gear, and arranged to come into work at a certain engine speed, has reduced this waste of power.

HAULAGE.

If we now consider the question of haulage, much will depend upon the position of the haulage plant and upon whether the colliery is a new or an old one. In the former case the haulage engine may (1) be put at the surface and main and tail or endless ropes taken down the up-cast pit; or (2) the haulage engine may be put down at the bottom of the down-cast pit and steam taken to it; or (3) in some cases both boilers and engines may be put underground, the boilers being fed with a split of fresh air and the hot gases utilized to assist the ventilation. The question of additional haulage plant would not be raised until the management was satisfied that the main haulage, which we will assume to be 2,000 yards in length, could not be extended further.

Let us first consider the case of the haulage required by a new colliery.

At once the question is raised of what motive power is to be adopted, the three possible powers being steam, compressed air and electricity. If the present haulage alone has to be considered and nothing thought of future extensions, the probable verdict will be to place the steam engine at the pit top and take driving ropes down the up-cast pit.

It must be apparent, so long as both the air compressor and the electric generator have to be driven by steam on the top, that a pair of horizontals of equal power driving a steam haulage, a compressed air haulage and an electric haulage, must yield a greater efficiency for steam haulage than either compressed air or electricity, as, whatever the losses may be in the steam engine, to these losses will have to be added, in the case of compressed air, the loss in compression, that in conveying the air down the pit in pipes to the motor and that in the motors. In the case of electricity there is to be added the loss in the generator, the cable and the motor. Against the steam haulage would have to be charged only the additional friction caused by taking the rope from the engine down the pit to the place where the electric motor or compressed air haulage engine would be placed. If we look at it from the point of view of first cost, we have to add the following to the cost of the engines, which is common to all three systems, viz.:

1. In the case of steam haulage, some 1,600 yards of rope, on the supposition that the shaft is 600 yards deep, and an endless rope is used, which would be a very small matter.

2. In the case of compressed air, the cost of the compressor and the air mains.

3. In the case of electricity, there would be the additional cost of the generator, cables and motor.

From this point of view the case in favor of steam haulage is still stronger.

If now the case of a steam haulage engine placed underground and close to the pit bottom is taken and compared with compressed air and electricity as before, we find the following: The efficiency and first cost of the compressed air and electrical haulage plant will remain the same. But in the case of steam haulage we have not only first to deduct the loss of efficiency due to the friction of the additional 1,600 yards of rope, but have to add the far more serious loss caused by the condensation and consequent loss of pressure in bringing the steam from the boilers to the haulage engine, a supposed distance of 800 yards.

The steam pipes would, no doubt, be well covered with non-conducting composition, which, the makers state, reduces the consumption of fuel by 15 to 30 per cent., due, doubtless, to the greatly reduced condensation in the covered pipes.

Mr. W. E. Garforth has stated that at the West Riding collieries steam is taken underground to a pair of 16 inch haulage engines, a distance of 526 yards, with a pressure of but 3 pounds to 4 pounds less than at the boilers.

He instances at the same colliery a pair of 15-inch engines, 187 yards from the boilers, supplied with steam from the top, with a loss of but 3 pounds in pressure and very little condensation.

Mr. H. W. Hughes, in his text book on mining, states that the loss from taking steam down the pit ranges from as little as 4 to 5 pounds to as much as 8 to 15 pounds.

At Broomhill colliery, Northumberland, steam is conveyed to a pump 1,414 yards from the boilers at bank. All pipes are well covered with non-conducting composition, and the loss by condensation is 21 per cent., while the pressure at the pump is 13 pounds below that at the bank.

Mr. Baure has stated that at the Bezinet colliery, France, steam is conveyed 400 yards from the boilers in 3¼-inch pipes with a loss of 18½ per cent. Thus, apparently, at the very worst, a loss of 21 per cent. is got from condensation in well-covered pipes, while in other well authenticated cases the loss is but some 6 per cent.

This wide range must depend on whether the shafts and roads are wet or dry and whether the pipes are taken down the up-cast or down-cast pit. The additional first cost of this plant would be the cost of the steam pipes and fixing them, from which must be deducted the saving of 1,600 yards of rope.

Mr. W. Meacham has recently stated that the first cost of an electric haulage plant put down at Haden Hill colliery was nearly double the estimated cost of a similar steam haulage plant under the above conditions.

It is clear that the additional first cost of the compressor would be the compressor itself.

On the supposition that there is a loss of 20 per cent. of efficiency, the steam engine still must be the cheaper motive power, both in first cost and efficiency.

The third case, in which both boilers and engine are placed underground, will next be considered.

This must be the most unsatisfactory of the three methods of arranging for steam haulage close to the shaft.

In the case of fiery collieries, which form by far the larger number of the collieries of this country, few, if any, would dare attempt such a thing, and her Majesty's inspectors would be certain to do their best to prevent such a dangerous arrangement.

So far as these collieries are concerned, we may at once dismiss this arrangement, which, however, in non-fiery collieries may be considered feasible, but it has such great disadvantages as to be inadvisable. Allowing that a small Lancashire boiler be required to provide the necessary steam, a second would have to be provided for times when the one required repairs and had to be knocked off for the necessary cleaning.

This alone would entail a large capital expenditure, which would be further added to by the large cost of the necessary foundations and the arches that would have to be turned over the boilers.

The providing of suitable water, free from excess of lime and CO_2, is frequently an insuperable difficulty, and, if found, would require to be carefully collected and piped down the shaft to the boilers. The boilers would doubtless be placed in an intake, and should, if possible, have but a short return to the up-cast shaft, where the gases would be utilized for assisting or creating the ventilation, together with the exhaust steam, unless arrangements were made for the condensation of the latter by the engine itself, which would be feasible if the system of haulage be endless rope.

To keep this road, arching would be necessary throughout, which would be a further expense. The cost of repairs to the boiler would certainly be great, owing to probable heavy firing during the working day and the daily after-contraction consequent upon the dampers being put in.

Thus the first cost of boilers and haulage engine would in this case fully equal the first cost of either the electric or compressed air plant.

An increased efficiency would doubtless be secured, as the full boiler pressure should be obtained in the engines. An additional man would be required to look after the boiler, and a considerable part of the fuel used would be additional to what would have been used had steam been brought from the top, both of which must add to the working cost. Beyond this there is the constant danger of firing either carbonaceous matter in the surrounding strata, or more probably the seam of coal itself in which the plant would probably be placed, unless an air space has been left all round the boiler seating and arching and part at least of the boiler flue. Summing up, the advantage of an increased efficiency would, in the writer's opinion, be outweighed by the increased working cost and the much larger first cost, and this arrangement is considered by him inadvisable, even in a non-fiery colliery.

Mr. A. L. Steavenson, when comparing the three powers—steam, compressed air and electricity—came to the conclusion that, for distances of less than a mile, ropes driven by an engine placed at land were cheapest, and for distances of a mile to 2,000 yards wire ropes gave results equal to any system of transmission. In his paper he quoted Prof. Reynolds, who stated that ropes have been found without question the most efficient means of transmitting power at long distances.

Haulage driven by means of a separate endless shaft rope is certainly the best method of bringing the ropes from top, the slow speed at which such ropes travel almost preventing breakage, while yielding a long life. In case of breakage, too, the defect is soon remedied, while main and tail ropes are frequently taken down shafts where the roofs are not good enough to allow of the width of road necessary for endless rope haulage. The higher speed at which these ropes must run greatly adds to the risk of breakage. The writer has frequently been struck with the needlessly high speed at which many main and tail ropes are driven. It is a pretty and striking sight to see a train traveling fast, but the consequent wear and tear of the rolling stock, the road and the ropes should be considered, and a rate of speed forbidden beyond that which is absolutely necessary to comfortably meet the cage. If possible, to prevent delay in case of accident, the ropes should be taken down the up-cast or fan shaft, which shaft, it is presumed, will be used for ventilation only, for raising and lowering men and for putting down timber. The ropes, too, should be allowed to hang clear in the shaft, simply passing over pulleys at the top and bottom of the shaft. This, in case of a broken rope, will prevent delay, and also, in the writer's opinion, prevent the great loss of time that has occurred with main and tail ropes when the rope has sloughed, probably at the entrance to the wooden rope trunk. Should the system of hauling by main and tail, it would be well to stop the rope while men are raised and lowered in the shaft.

While in the writer's opinion there can be little doubt that haulage driven by steam on the top and haulage driven by steam taken down the pit is more efficient and cheaper in first cost than when either air or electricity is used, and that with boilers placed underground the efficiency is probably greater, the first cost is approximately the same, and the working cost the same as for either compressed air or electricity, yet when the time has come for the main haulages to be extended the conditions are quite altered.

We will suppose that the main haulage plane of a fiery mine is 2,000 yards long and has to be extended, say, a further 1,500 yards.

COMPRESSED AIR VERSUS ELECTRICITY.

Reliable data are now obtainable to decide the relative efficiency of compressed air and electricity. We will first consider compressed air. In an able paper read recently at the South Wales Mining Institute Prof. Elliott gave the following figures. On the ordinary simple adiabatic system of air compression, and neglecting certain losses, he found by calculation the efficiency of transmission, i. e., the ratio of the indicated horse power developed in the motor cylinder to the indicated horse power absorbed in the compressor cylinder to give in the case of a pressure of 90 pounds—which is the pressure at which the Popp installation of compressed air at Paris works—an efficiency of 59·5. But Prof. Kennedy found by actual measurement that he got for this efficiency but 46·1, and the difference represents the losses overlooked. Prof. Elliott also found that a compound system would have a possible efficiency of 77 per cent., and the triple system a possible efficiency of 84 per cent. On correcting his estimate in the ratio of 46·1 to 59·5, he got the probable actual efficiency of:

	Per cent.
Simple	46·1
Compound	59·8
Triple	65·2

If, however, we take this efficiency to be the ratio of the indicated horse power in motor cylinders to indicated horse power developed in the steam cylinder of the compressor, and making the same correction, we get:

	Per cent.
Simple	39·1
Compound	50·7
Triple	55·3

Allowing for losses on the scale found to exist by Prof. Kennedy in the Paris machinery, and reckoning from the steam cylinders to the motor cylinders, we get the following probable efficiency:

	Per cent.
Simple compressor and simple motor	39·1
Compound compressor and simple motor	44·9
Triple compressor and simple motor	46·9
Compound compressor and compound motor	50·7
Triple compressor and triple motor	55·3

Prof. Kennedy in the Paris experiments found the mechanical efficiency of the motor to be 0·67. This is somewhat low. If we take 80 as a good average value of the mechanical efficiency of the motors, we have for the efficiency of the several systems under the conditions assumed and reckoned from the steam cylinders of the compressors to the driving point of the motors the following results:

	Per cent.
Simple compressor and simple motor	31·28
Compound compressor and simple motor	35·92
Triple compressor and simple motor	37·52
Compound compressor and compound motor	40·56
Triple compressor and triple motor	44·24

Take an installation working on the simple adiabatic plan at the reservoir pressure of six atmospheres absolute, the saving of indicated horse power in the steam cylinders of the compressor which would be effected on replacing the old by each of the new systems would be found by calculation to be:

	Per cent. saving
Compound compressor and simple motor	12·9
Triple compressor and simple motor	16·7
Compound compressor and compound motor	22·9
Triple compressor and triple motor	29·3

These figures show that with the ordinary simple compressor but 31·28 per cent. of efficiency is got, which in general practice probably would drop to 20 per cent. or at most 25 per cent., and if a compound compressor and a simple motor be used, as have been adopted for several large air compressing plants now being put down in South Wales, an additional 4¾ per cent. is got. If both compressor and motor are compounded, as has been done at the Newbattle collieries, an additional 9½ per cent. is obtained.

These figures are not encouraging, and it may be questioned whether the additional efficiency obtained from compounding the compressor, or both compressor and motor, will authorize the additional capital expenditure necessitated by the additional plant.

Practically, with the same pressure of transmission we can obtain this increased efficiency; or with the same efficiency we can obtain a reduction in the size of the supply pipes and plant if we adopt a higher initial pressure, which probably would be found the better plan financially. The following are some of the practical difficulties which cause this low efficiency and the suggested and practical remedies.

The isothermal system of compression having been found unattainable in practice, adiabatic compression alone has to be considered.

(To be continued.)

One hundred miles of the Uganda Railroad have been completed and will be thrown open to traffic at once. There remain 300 miles to be constructed before the Victoria Nyanza is reached. The last 40 miles were laid down in a little over two months.

ELECTRICAL NOTES.

According to the English journals the declaration of "Officier de l'Ordre Léopold" has just been conferred upon Prof. D. E. Hughes, of London, by the King of Belgium, says The Electrical World. The Hughes type printing telegraph has been used largely on the Belgian government lines for over twenty-seven years.

At the end of October, 1896, there were in use in Paris 545,914 electric lamps and in London 1,178,000, according to Zeitschrift für Architectur. The feeding current was in Paris 8,107,253 kilowatt hours, and in London 10,000,000 kilowatt hours, approximately. In Paris the price per kilowatt hour was 1·25 franc and in London 0·65 franc.

The Baltimore and Ohio Southwestern Railway has been trying electric motors on turntables, says Locomotive Engineering. It cost an average of less than one-half a cent for each time the table was turned. When the same table was operated by hand, it cost twelve cents for each engine. The yearly saving is said to be about $709.

We believe it is a general stipulation in American tramway specifications that the trolley wire should stand a breaking strain of 30 tons per square inch. To some extent consulting engineers in this country, says the English Electrical Review, are insisting upon a similar strength; but it is questionable, not only whether 30 tons is necessary, but whether that figure is ever obtained in ordinary practice. From some recent tests carried out on both English and American trolley wires, it would appear that the average test is about 23 tons per square inch, as will be seen from the following:

ENGLISH WIRE.

	Tons per square inch.
Sample A.....No. 0	23·4
Sample B.....No. 0	23·9
Sample C.....No. 0	23·9
Sample D.....No. 0	24·07

AMERICAN WIRE.

Sample A.....No. 0	20·2
Sample B.....No. 0	23·4
Sample C.....No. 0000	21·1

It would, at any rate, appear that some of the American wire sent to this country is a long way short of 30 tons per square inch, though it would no doubt withstand all the strains that are likely to be put upon it in practice.

The Pennsylvania Railroad Company has decided to lend its aid in the work of solving the problems, also doing this in co-operation with the mechanical engineers and scientists and men of financial authority who are associated with George Westinghouse. The Pennsylvania company has already laid a track for the purpose of making these experiments which offers five miles of trackage, and is placed in a singularly convenient region for the accurate testing of various plans and inventions, the swift remedy of defects and the careful study of every appliance which any person may offer for inspection or test. The tracks, says The Philadelphia Press, have been laid down in East Pittsburg, almost parallel with the Pennsylvania Railroad tracks, although in the valley beneath those tracks, in which the Westinghouse works are situated. Already in those vast yards a system of electric propulsion has been in use for several years. By it the freight cars, which are switched into the yard and which carry from the works the machines destined for distant markets, have been hauled with economy, perfect ease and method. It is what is known as the button system. The third-rail system is also to be tested in every detail. The tracks which the Pennsylvania Railroad has established, and which the Westinghouse people are utilizing with an electric car, are supplemented by two interior rails. That is to say, it is not a single third-rail system, but is what may be called the double third-rail system. This system is now being tested upon these tracks, very largely for the purpose of determining whether the element of danger can be completely eliminated, and, if this can be done, whether the system thus established can be operated as economically and as satisfactorily in other ways as the third-rail system with the live rail, such as President Clark is using upon the branch line near Hartford, Conn.

A dispatch has been received at the Foreign Office from the British minister at Belgrade, on the subject of a contract between Mr. Hugo Luther, of Brunswick, and the Servian government, which has passed the Shupshina, and has been promulgated as a law in the Servian Official Gazette. The rights conferred on Mr. Luther by this instrument are of a remarkable and extensive nature, says The Electrical Review. He will enjoy for 99 years the exclusive privilege of drawing mechanical and electrical power from the cataracts on the Servian shore of the Danube, and of applying same to any industrial undertaking on which he may decide to embark. During the first 30 years of this period his plant, buildings and industrial undertaking are exempted from the payment of every description of impost, taxes, octroi or custom dues on the importation and exportation of machinery, material and produce. Within four years from the date of the contract, Mr. Luther must erect motor plant and buildings at the cataracts to the value of 2,000,000 dinars, and electric power for working purposes must be available within a period of eight years, failing which, he forfeits all his rights under the contract, with the exception of those over mines. Within 20 years electricity to the amount of 15,000 horse power must be forthcoming, and every cataract then unused by Mr. Luther reverts to the state, which may allot them to other parties after Mr. Luther has been given the option of using them. At the end of 99 years the state may exercise a right of pre-emption over the power-producing plant and buildings. All matters of dispute between the state and the concessionaire are to be adjusted by a court of arbitration to be specially appointed, whose members will be chosen in equal proportion by the government and by Mr. Luther. This measure places mineral forest resources of nearly 600 square miles of the northeastern portion of Servia under the control of foreign capitalists. The capital required by Mr. Luther will probably be shortly raised in Germany.

MISCELLANEOUS NOTES.

A diamond in constant use for cutting cold glass lasts about three months, but if used to cut hot glass, it would only last for one day.

Sumatra petroleum promises to be a rival of Russian and American oils in Japan. A Yokohama firm has ordered 40,000 cases of the Sumatra oil. The packing cases are to be made of American lumber.

The general annual return of the British army for 1896 shows an average effective strength of 220,742, subdivided thus: Household Cavalry, 1,300; Cavalry of the Line, 18,284; Horse Artillery, 3,785; Field Artillery, 14,451; Mountain Batteries, 1,408; Garrison Artillery, 17,663; Royal Engineers, 7,833; Foot Guards, 5,850; Infantry of the Line, 137,022; Colonial Corps, 5,218; Army Service Corps, 3,517; Ordnance Corps, 1,210; Medical Staff Corps, 2,632; and Army Pay Corps, 569. 76,937 of all ranks were quartered in England, Wales and the Channel Islands, 3,630 in Scotland, and 25,841 in Ireland (being an average at home of 106,408), 38,884 in the Colonies and Egypt, and 75,450 in India. The net loss from desertion was in the downward direction, namely, 3,367, as against 3,453 in 1895, and 5,423 in 1886. In addition there are 78,182 Reservists, 117,773 Militia, 30,374 Militia Reserve, 10,362 Yeoman Cavalry, 229,034 Volunteers.—Army and Navy Journal.

Certainly there is nothing more uninteresting to the metallurgist, says The Engineering and Mining Journal, unless it be an essay in pure mathematics, than an account of the redetermination of the atomic weight of a certain element. The question is often asked, Why are new determinations important? Are not those now accepted good enough for practical purposes? To this question Mr. F. W. Clarke makes the following answer: There are two rival values for the atomic weight of chromium. The 52·5 based on the old work of Berlin is still used by European analysts; the other, 52·1, based on later and more accurate researches, is used in the United States. The Baltimore chrome ore works import chromic iron in cargoes of about 2,500 tons, which are assayed in Glasgow and Baltimore. The chemists of the former city based their percentage calculation on the atomic weight of chromium, 52·5, and those of the latter place on 52·1. The variation in percentage resulting from this amounts to a difference of $367.50 in the value of a cargo.'

It is not uncommon for noblemen with picture or sculpture galleries 100 feet long to find a difficulty in keeping their servants. Lord Londonderry has a gigantic house in Wynyard Park, Durham, 300 feet long, which is bad enough; but the sculpture gallery, which is 101 feet long by 58 feet high, contains no less than 700 pieces of statuary and 500 paintings. This gallery has to be swept out and dusted every day. Suffice it to say that Lord Leconfield is the owner of Petworth House, a truly wonderful building, 322 feet long, and containing over 100 rooms, many of them of vast proportions. The Duke of Richmond's house at Goodwood, with its two wings, measures 378 feet, and gives employment to over sixty domestics. There are 125 rooms in Castle Howard, the Earl of Carlisle's residence near Maldon, Yorks. When it was refurnished some years ago, forty suites of new furniture were required. We will conclude with a brief reference to Eaton Hall, Cheshire, the seat of the Duke of Westminster. The writer well remembers, when going over this house, being taken to a corridor which runs the whole breadth of the building. "How far is it to the other end?" I asked. "Four hundred and seventy-two feet," was the reply.—Illustrated Carpenter and Builder.

A new ticket printing machine now being introduced to the notice of the English railway companies is designed to simplify the work of the ticket issuing department and to facilitate audit, says The Colliery Guardian. This new machine is intended to supersede a central ticket printing office altogether, and to enable the booking clerk to print each ticket as it is asked for by the passenger. At one side of the machine there is a wheel on the circumference of which are engraved the names of the various stations. This is turned round until the name of the station for which a ticket is desired comes opposite the pointer. In front are several levers; when one of these is touched, according to the class required, a printed ticket is forthwith delivered bearing the names of the stations from which and to which it is available, the class, the fare, the date, the serial number, and any other particulars that may be wanted. If the pressure on the lever is continued, tickets printed in this way, and all serially numbered, may be poured out at the rate of one hundred a minute. At the same time the number, distinction and price of each ticket issued are automatically registered on continuous rolls of paper, one for each class, which are locked up within the machine and can only be reached by the official to whom the key is intrusted.

Japan has shown herself so remarkably go ahead in recent years that we read now without much surprise of the strides made by her chief ports and cities, says The London Financial News. Hakodate is no exception to the general rule, and our consul there, in his report on its trade during 1896, gives some striking figures. The total foreign trade of the port last year amounted in value to £132,639, an increase of £34,860 on the total in 1895, or at the rate of nearly 35 per cent. The exports rose from £81,075 to £97,360, while the imports more than doubled, leaping from £16,704 to £35,279. This was partly due to the importation of railway material. In the table of exports those to China stand first with a total of £57,329, against £45,875 in 1895; but in the import table the flowery land is last but one, with the insignificant total of £139, against £181 in the previous year. Exports to the United States come next—£22,263—a falling off of 1895's figures of about £3,000; while the imports thence stand lowest with £75 only for 1896, against £218 for 1895. Exports to Russian Asia rose to £10,983 from £2,471 in the preceding year; and the imports thence sprang from £5,007 in 1895 to £16,650. Great Britain, which stands fourth in Hakodate's list of exports, is an easy first in the list of imports, the figures being £18,149, against £11,124 in 1895. This, although not such a relatively large increase as the imports from Russian Asia, shows that our commercial intercourse with this rising Japanese port is being well sustained.

SELECTED FORMULÆ.

Poultry Food.—There is a great similarity between the various poultry powders and foods. The powders are popularly supposed to increase the egg-laying power of hens. We quote a few typical formulas:

Powdered eggshell or phosphate of lime	4 ounces.
Iron sulphate	4 "
Powdered capsicum	4 "
Powdered fenugreet	2 "
Powdered black pepper	1 "
Silver sand	2 "
Powdered lentils	6 "

A tablespoonful to be mixed with sufficient feed for twenty hens.

Oyster shell, ground	5 ounces
Magnesia	1 "
Calcium carbonate	3 "
Bone, ground	1½ "
Mustard bran	1½ "
Capsicum	1 "
Sodium chloride	1 "
Iron sulphate	½ "
Sodium carbonate	½ "
Sulphur	½ "
Beef, lean, dried and powdered	10 "
Fine sand	10 "
Corn meal	20 "
Linseed meal	20 "

Reduce all to moderately coarse powder and mix well.

The above are formulas that are recommended by poultrymen, and pharmacists should not condemn them, even if they do seem polypharmic. Poultrymen have ideas of their own about the value of complicated formulæ.—American Druggist.

Luminous Calcium Sulphide.—Calcium sulphide as used in the manufacture of luminous paint may be prepared upon the small scale by the following process: Boil for one hour 2½ ounces of caustic lime, recently prepared by calcining clean white shells at a strong red heat, with 1 ounce sulphur and 1 quart soft water. Set aside in a covered vessel for a few days; then pour off the liquid, collect the clear orange colored crystals which have deposited, and let them drain and dry on bibulous paper. Place the dried sulphide in a clean graphite crucible provided with a cover. Heat for one-half hour at a temperature just short of redness, then quickly for about fifteen minutes at a white heat. Remove cover and pack in clay until perfectly cold. A small quantity of pure calcium fluoride is added to the sulphide before heating it. It may be mixed with alcoholic copal varnish. Sulphides of barium and strontium also give phosphorescent powders when duly heated. Each sulphide has a predominant color, but the temperature to which it is heated has a modifying effect on the color. Calcine in a covered crucible, along with powdered charcoal, sulphate of lime, sulphate of barytes, or sulphate of strontia; there is produced in each case a grayish white powder, which, after exposure to strong light (either sunlight or magnesium light), will be phosphorescent, the color depending on the sulphate used and the degree of heat employed.—Pharmaceutical Era.

To Color Iron Blue.—One hundred and forty grammes of hyposulphite of soda are dissolved in a liter of water (4¾ ounces to 1 quart); 35 grammes of acetate of lead are dissolved in another liter (1¼ ounces to 1 quart); the two solutions are mixed, are made to boil, and the iron is immersed therein. The metal takes a blue color, such as is obtained by heating it.

Receipt for Ink to Write on Glass.—

Water	500 parts.
Borax	75 "
Alcohol	300 "
Fish glue	40 "
Methyl violet	2 "

By volume. The ink is indelible, and very easily applied to the surface of the glass.—Cosmos.

To glue celluloid to wood, leather, etc., use a mixture of 1 part of shellac, 1 part of camphorated spirits, and 3 or 4 parts of 90 per cent. alcohol. A collodion solution may also be used, or an alcoholic solution of fine celluloid shavings.—Uhland's Wochenschrift.

To color ivory brown, apply several coats of an ammoniacal solution of potassium permanganate. Similar results are obtained if the solution is diluted with vinegar, and the ivory article allowed to remain in the liquid for some time.—Uhland's Wochenschrift.

To whiten old ivory, wipe it with flannel which has been wetted with essence of turpentine, then expose for several days to the sun.—La Vie Scientifique.

A Solder for Aluminum.—As an important article in mechanical construction, aluminum is slowly but surely finding a place for itself, but one obstacle to its more general introduction has been the difficulty experienced by manufacturers to find a solder that will successfully effect a juncture between parts. The Journal of the Franklin Institute now gives a recipe for a solder which is said to serve the purpose. It is called Green's solder, and is composed of zinc 50·03 per cent., tin 47·99, aluminum 1·76, and phosphorus 0·22 per cent. It is not used with any flux, simply requiring the aluminum faces to be cleaned and first coated with the solder, then with a clean hot soldering bit to wipe the soldered joint to be made. This may be a very good solder, but if such extreme accuracy as the decimals imply is really necessary in apportioning the ingredients, we fear it will operate against its general use.

Adhesion of Cork to Metal.—In fastening cork to iron and brass, even when these are lacquered, a good sealing wax containing shellac will be found to serve the purpose nicely. Wax prepared with resin is not suitable. The cork surface is painted with the melted sealing wax. The surface of the metal is heated with a spirit flame entirely free from soot, until the sealing wax melts when pressed upon the metallic surface. The wax is held in the flame until it burns, and it is then applied to the hot surface of the metal. The cork surface painted with sealing wax is now held in the flame, and as soon as the wax begins to melt, the cork is pressed firmly on the metallic surface bearing the wax.—Pharm. Centralhalle.

SCENES AROUND PNOM-PENH, THE CAPITAL OF CAMBODIA.

ONE of our correspondents in Pnom-Penh sends us a few interesting photographs of this region, which but very recently was causing itself to be talked about. It was a question of nothing less than a coup d'etat, as a sequel to which King Norodom was dispossessed of his throne under the pretext that he had given signs of mental alienation.

In the train of these events, the resident general was changed, and replaced by M. Ducos, whose merits have caused him to be highly appreciated in these quarters.

This region is of uneven aspect, with a central canal of which the emanations are unwholesome to such a degree as to cause cholera when the water gets low. The landscape is picturesque: and picturesque, too, are those returns from hunting that unite numerous sportsmen around the game that has been killed during the day. Wonderful accounts are given of these hunting expeditions, in which there usually occurs a surprising slaughter of pea fowl, deer, and wild boars, the number of which would make our European Nimrods pale with envy. But, doubtless, more original still is this imposing line of elephants massed in an alley of the garden of the official French residence, and upon which are seated the guests invited to an excursion organized by Mme. Ducos. One thinks involuntarily of Hamilcar's elephants in the narratives of the battle of Salammbo.

As a background to the picture, we see curiously and capriciously profiled the pyramidal towers of the pagoda of Pnom-Penh, one of the most celebrated edifices of the country. This pagoda, it is said, was erected through the piety of Lady Penh, a Cambodian of ancient times.

The capital of Cambodia, moreover, borrowed its name from the hill upon which this edifice stands. The name is from pnom, "mountain," and penh, "great abundance.'

The hill was made by the hand of man, and the pyramid was erected over the place of sepulture of him who had it constructed, some eight hundred years ago, that is to say, along about the year 1080 of the Christian era, or in 1680 of the Buddhic era of Cakia-Monni, the golden age of Khmer architecture.

If tradition is to be believed, the Khmers were one of the first barbarous tribes that occupied Cambodia. Aside from the structures that are attributed to their art, and of which the pagoda of Pnom-Penh and the celebrated ruins of Ang-Kor give the best idea, scarcely anything exists relating to them except legends. The latter speak of a certain Bautumo Saurivong, whose name in Hindoo signifies "the lotus, son of the sun," and to whom the pagoda of Ang-Kor is attributed. The present Cambodians consider themselves as the descendants of these Khmers.

Pnom-Penh is situated upon the left bank of the Mekong, near the confluence of the arm of the lake, at 144 miles from Saigon and 84 miles to the north of the Gulf of Siam.

The city is built upon a marvelous site. It is the residence of the king, of the resident general of France, and of the resident of the province. Although the smallest of the kingdom, this city is the richest and most densely populated. It contains 340,000 inhabitants. Besides the pagoda spoken of above, there are here several other prominent edifices, the principal of which are the king's palace, the habitation of the chief of the bonzes, and the elegant buildings of the French protectorate, opposite which there is a large pleasure garden, the flower beds of which adorn the shores of the Mekong.—Le Monde Illustré.

THE MUSÉE SOCIAL AND ITS WORK* IN SWITZERLAND.*

THE Musée Social of Paris, France, is a privately endowed but public institution, the object of which is to advance the study of practical labor questions throughout the world. Though in no way a state institution, it may be said to be a labor bureau the maintenance of which is provided for by funds with which it has been privately endowed. Under these circumstances its organization and work merit a special interest. The Musée was created in 1894 by the Comte de Chambrun, who gave for that purpose the sum of 1,700,000 francs ($328,100), but it was not definitely organized and inaugurated until March 25, 1895. Its objects, in the language of the constitution, are "to place gratuitously at the disposition of the public documents with collateral information, models, plans, constitutions, etc., of social institutions and organizations which have for their object and result the amelioration of the material and moral situation of the laboring classes."

Unlike the various economic associations and societies, it as far as possible avoids mere academic discussions, and confines its attention to matter relating to practical labor questions. In this it follows strictly the line of work of official labor bureaus. In a building owned by it, it has accumulated a library of all the principal official reports, publications of private associations and industrial organizations, and private treatises printed in all languages bearing upon practical labor problems. It has fitted up rooms for lectures and meetings and for students who desire to make use of the library. It has a permanent exhibition of models, plans, etc., of workingmen's houses, devices for preventing accidents, constitutions of social institutions of all kinds, etc. It provides for lecture courses on labor problems.

As regards its own direct contributions to a knowledge of labor conditions, it from time to time organizes special commissions in France and in foreign countries to inquire into labor subjects of present practical importance. The publications of the Musée Social naturally constitute a very important part of its work. Of these there are several kinds. It issues from time to time volumes in a series entitled Bibliothèque du Musée Social, which give the results of its investigations and other material representing the results of original research. The second class of publications consists of more frequent bulletins, or circulaires, as they are called, for the publication of shorter contributions. There are two series of these bulletins, the first of which is intended for a wide gratuitous circulation among the working classes and is devoted to giving information concerning current happenings relating to labor, such as the meetings of labor congresses or organizations, social legislation, etc. The second series embraces studies more in the nature of economic monographs. A most important feature of these bulletins is the valuable bibliography of reports and works relating to the question under treatment, which is always appended.

The bulletins relating to the insurance of workingmen against idleness in Switzerland are of such general interest that their contents are here summarized. Switzerland is apparently the only country in which serious efforts have been made to lessen the evils of lack of employment through the creation of special state insurance institutions. The first attempt to provide for insurance against idleness under government auspices was made by the town of Bern, in April, 1893. It provided for the creation of an institution, membership in which was to be purely voluntary. Each member was required to pay monthly dues of 40 centimes ($0·077). To the fund thus accumulated the town agreed to add a subsidy the maximum amount of which was limited to 5,000 francs ($965) a year. The constitution also provided for the receipt of gifts from employers and other individuals. This relief would be granted only during the months of December, January and February.

Only members of six months' standing who had paid their dues regularly and had been unemployed at least fifteen days are entitled to benefits, and then not for the first week that they are without work. A workingman who refuses work of any kind loses all right to aid of any kind. There are also other cases in which the workingman loses his right to a benefit. Such, for instance, are the cases where he is unemployed as the result of his own fault, and especially when he has engaged in a strike. The fund is administered by a commission of seven members, of which three are named by the municipal authorities, two by the employers contributing to the fund, and two by the workingmen.

AN EXCURSION ON ELEPHANT BACK AT PNOM-PENH, CAMBODIA.

This institution has now been in existence a sufficient length of time to furnish some indication of the character of the results. The members have contributed but 14 per cent. of the total receipts and they have received in actual benefits six times the amount paid in by them as dues. One would think that under such exceptionally favorable circumstances membership would increase rapidly. Such, however, has not been the case. During the second year, 1894-95, there were but 390 members, or 14 less than the preceding year. Two hundred and nineteen persons, or more than half the members, were aided. They received $1,869.06, or an average of $8.53 each. This institution had been founded for but two years as an experiment. In 1895, the two years having elapsed, the town council determined by an almost unanimous vote to continue it in operation. Some modifications, however, were introduced in its organization, and the municipal employment bureau, which had until then been an independent service, was attached to the work of the insurance fund.

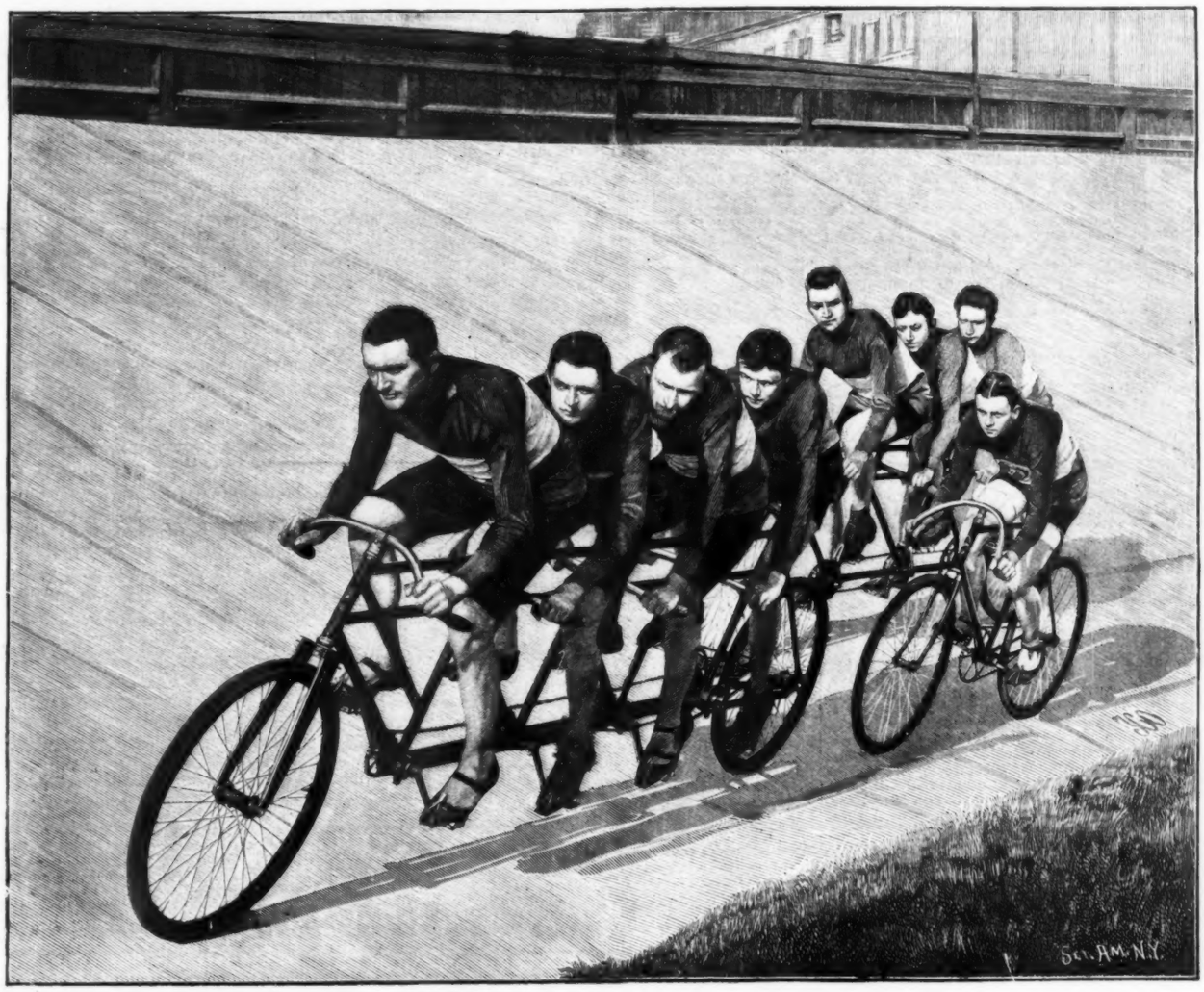
Saint Gall, a town of about 30,000 inhabitants, was the first to follow the example of Bern and provide for the insurance of workingmen against idleness. Its policy, however, differed radically from that of Bern, in that it adopted the policy of compulsory insurance. Its institution was created June 23, 1895. After an existence of about a year and a half, its suppression, after June 30, 1897, was voted by a majority of the electors of the town November 8, 1896. The reasons for its abolishment were that the system of compulsion worked badly. At Basel, although no scheme of insurance has as yet been put into operation, a proposition for the compulsory insurance of workingmen

* Bulletin of the Department of Labor, Washington, D. C., March.—Public Opinion.

against lack of employment through a municipal institution has been elaborated, in which the attempt has been made to meet the objections that were urged against the Saint Gall experiment. The question of insurance against lack of employment has also received attention in other Swiss cities, notably Zurich and Lucerne, but no actual steps in this direction have as yet been taken. The federal government is now prosecuting an investigation of the whole subject of lack of employment and the means of preventing or lessening the evils resulting from it. The complete report of this investigation has not yet been made.

ALFRED KÖCHER AND HIS PACE MAKERS.

WE publish herewith an engraving of Alfred Köcher and his pace makers. For this picture, which was taken from an instantaneous photograph, we are indebted to our worthy contemporary the Illustrirte Zeitung. At the races which were arranged in the Friedenau-Wilmersdorf Park, near Berlin, for the benefit of the sufferers from the flood, Köcher succeeded in making 1·8 miles in 3 minutes 31⅘ seconds, thus beating the 3 minutes 32 seconds record of Joseph Fischer, which had formerly led the world. Köcher also made the road run of 62 miles in six minutes less than it had been made before, covering the distance from Zossen to Lübben and back in 2 hours, 51 minutes and 53⅕ seconds.



ALFRED KÖCHER AND HIS PACE MAKERS.

THINGS AMERICAN.

By MARCUS BENJAMIN, Ph.D.

IT is a curious peculiarity of most people that they desire to obtain some reminders of places that they have visited. In a way, the habit is a good one, but, unfortunately, it is apt to degenerate into vandalism, and a piece of a curtain from the Palace of Sans Souci or a button from a Napoleonic uniform, obtained at the price of a generous douceur to the guide, is too frequently the kind of souvenir that the traveler brings back from abroad with him. On the other hand, a carved piece of bogwood from Ireland, a bit of porcelain from Sevres, a mosaic from Florence, a sash from Rome or a piece of glass from Venice, a miniature wooden chalet from Switzerland, an agate from Oberstein, or something in iron from Berlin, are indeed pleasant reminders of a visit to the old world.

It has often seemed strange to me that Americans, who travel so much about their own country, should have so completely ignored those things that are peculiar to the many places within our own land; and yet there is scarcely an important city in the United States that has not some one thing that is made nowhere else. Some of these deserve special mention, and as an interest, largely fostered by our sons, daughters and dames of patriotic societies, has been developed in "Things American," it seems well to describe some of the "things" that I have gathered.

At first blush it would appear as if in so great a city as New York, where everything can be had, no matter from where it originally came, no special memento, peculiar to the metropolis itself, was procurable, and yet there is nothing so artistic, so beautiful and so unique among the products of American industries as the Favrile glass, which Mr. Louis C. Tiffany has recently invented. It is made into a variety of original forms in vases and other objects of interest to collectors and lovers of art.

The new combinations of color with color, of color over color, the deepening of tone, the subtile quality of the texture, the introduction of new colors, the union of metal with glass, and the wonderful ornamental effects obtained by embedding lines and threads of one colored glass into that of another while they are in a molten state and during the operation of blowing, are among the characteristics of this beautiful invention.

As we journey from New York toward the South, Trenton is reached, and the collector of things beautiful would, indeed, find it a difficult task to get away from the sample rooms of the potteries of that city. Perhaps, if he goes to the right place, he may find some bit of modern historical ware, such as the exquisite pieces of Belleek, that were made for the World's Fair, held in Chicago; or a piece of the china set, with the heads of George and Martha Washington, that were made in 1876. There is also an interesting after-dinner cup and saucer, that I recall having seen, that was made for the New Orleans Exposition, in 1881.

Philadelphia is large, and while there may be things that are more characteristic, I have contented myself with the quaint toby jug, in old Rockingham ware, made there, and the two English plates, made in 1876, with prints of Independence Hall and the public buildings on them. The Mint affords one an opportunity of securing a specimen set of the silver coins, or, perhaps, one of the medals made there, certain of which are exceedingly beautiful.

As we go west from Philadelphia, Gettysburg—famous as the field of the greatest of modern battles—may be taken in on the way. Bullets, pieces of shell, bayonets and the like are still common and far too plentiful to be other than genuine. It was less than ten years after the battle when I first visited the field, and then, among the "relics," that which most attracted my attention was a lamp, the bowl of which was made from an unexploded shell that had been carefully emptied of its dangerous contents.

At Summit Hill, in Carbon County, Penn., are to be had what are called "anthracite coal novelties." These are simply carvings in the hard coal, which takes a polish similar to jet; and they are quite attractive, especially when care has been taken to secure a specimen containing a vein of pyrite.

The largest aluminum works in the world are, probably, those near Pittsburg, and a pleasant souvenir of a visit to that city, so noted for its metallurgical works, is a plaque of the coming metal. A medallion, with the head of Woehler, who discovered the element, modeled in high relief, brings to mind some bitter cold days spent there several winters ago.

Baltimore is the home of the Chesapeake Pottery, and a specimen from its kilns—perhaps a cracker jar—in the Severn or Calvert pattern, is something that cannot be found in every city; while the "Rebekah at the Well" teapot, that originated in a pottery nearer the center of the city, is still procurable, but certainly not in the bric-a-brac shops, for there they prefer to sell, at fancy prices, English cups and saucers, decorated with views of the city.

The rare old blue plates with which the Baltimore and Ohio Railway celebrated its completion in 1828 will sometimes reward the antiquarian who is willing to spend time and money to secure one of these treasures, on which is printed the little, stumpy locomotive that was built by Peter Cooper, early in the century.

It is in Washington that we find something, perhaps, more unique than elsewhere. No visitor to the capital city of the Union can have failed to have observed the various souvenirs, made of a plastic material and in many shapes, and having a grayish color, that are everywhere for sale. They are of paper pulp, obtained from the government bank notes that have been reduced and macerated at the Treasury Department. The operation is an interesting one to see. Each object bears a small label giving the estimated value of the original bills, and one may easily bring away with him a souvenir with an estimated original value of $50,000. Less unique, but at one time quite common, were bits or chips of stone from the Washington Monument. On many of these were crude paintings of the tall white shaft, or else of some public building in Washington. At Mount Vernon canes and other commonplace objects in wood, grown on the place, are for sale, but they are without special interest.

The battle fields of Virginia afford relics, and a company in Richmond, Virginia, advertise a tastefully finished cane, ornamented with a silver plate, upon which is inscribed the name of the battle field from which it came, cut from any one of the following historical fields of the late war: Seven Pines, Fair Oaks, Gaines' Mills, Garnet Farm, Malvern Hill, Cold Harbor, or Petersburg.

The deposits of phosphate rock in South Carolina yield fossil sharks' teeth that form convenient paper weights, which are common in Charleston, where also the brilliant plumage of semi-tropical birds may be purchased, and with which fans are easily made. In Florida, especially in Jacksonville and St. Augustine, there are stores where paper cutters and other objects, carved from orange wood, are to be had. Stuffed alli-

gators, so small as to be easily packed in a glove box, are everywhere sold. Fans in bright colors, like those from Cuba and Spain, with views of St. Augustine, from the old San Marco to the modern Ponce, are equally common. Shells and strange seeds, made into jewelry, abound; while pieces of the curious coquina stone, cut in squares or bricks, are sold for a few cents. It is with this material that many of the newer and beautiful buildings in St. Augustine are built.

It is in New Orleans that the curious carving wares from Mexico begin to appear. Here we find the strange pottery from Guadalajara, and the wax figures that the nimble fingers of the native artists fashion with such ease. Many of these are made in New Orleans itself. Nor must the feather work be forgotten, for it is not uncommon. But that which I value most from New Orleans are the Indian Choctaw baskets, that are still to be had in the French market. If the makers of them are as old as the saleswomen, surely, in years to come, they will be rarities of the first water, commanding high prices. Miniature cotton bales, that purport to have been made during slave times, are not without interest, and may be found in shops in Canal Street.

Before leaving the Southern States, it is well to remember that specimens of Confederate postage stamps and Confedrate bills are on sale in many of the cities below Mason and Dixon's line.

If we ascend the Mississippi to St. Louis, we may be fortunate in finding some authentic piece of pottery from the mounds near that city. The vicinity is rich in the remains of that prehistoric people about whom so little is known. Indeed, St. Louis itself is on the site of several mounds. Magnificent quartz crystals are to be had for next to nothing at the Hot Springs, in Arkansas. Specimens that exceed in beauty the famous crystals from Switzerland are on sale along the principal street of the resort.

In Texas, steer horns, fully as beautiful as those from the cattle in the vicinity of Rome, Italy, are often to be found, and may be had for the asking. In San Antonio, with its never to be forgotten Alamo, and its beautiful missions that are slowly but surely crumbling into ruins, the products from over the line are sold to the curiosty hunters. Monkey jars and water bottles, feather work and carved onyx are seen in the shop windows.

Turning abruptly north, we find in Denver curiosities that are of Indian origin; but to my mind, the sprouting silver buttons that resemble an open rose are most interesting, while the large green garnets from Salida, that occur in perfect crystals, are souvenirs of greater local interest. Santa Fé is par excellence the place to purchase Indian pottery. Jake Gold's museum is known the world over, and in it may be had genuine specimens from most, if not all, the New Mexican Indian handicrafts. The Navaho blankets, that are so highly prized, are to be had here, while the more brilliant Mexican blankets, made in Santa Fé itself, are sold for far less than elsewhere. The smaller blankets, that cost from $3 to $4 in Santa Fé, readily command $10 to $15 on the Pacific coast. Indian baskets, from the coarse yucca to the more closely woven ones, are to be had, while silver ornaments, made by the Indians, will sometimes reward those who know what to ask for; and the still rarer paintings, on elk skins, are occasionally to be had. Gems, including agates and the turquoise from the Los Cerillos mines, near by, are sold in Santa Fé at reasonable prices, while on the south side of the Plaza are silversmiths, who make the curious filigree silver work that recalls a similar art practiced in Florence and elsewhere in Northern Italy.

From Santa Fé westward along the lines of either Atlantic and Pacific or the Southern Pacific Railways, Indian curiosities are procurable at all the larger towns. The large black ollas from Santa Clara, New Mexico, make handsome ornaments, and certainly much of the grotesque pottery of the Pueblo Indians is worth buying. At El Paso there are Mexican curiosities to be had, and especially if one is willing to cross the river into old Mexico by the only international horse car line in the world he will find large stores where Mexican opals that seem almost to have borrowed their brilliancy from the sun are common, while the rag, wax and feather work are lavishly displayed. Carvings of the so-called Mexican onyx, mostly of fruits, may be bought at reasonable prices, and one firm offers a ninety page catalogue with over one hundred illustrations for ten cents.

Near Fort Yuma, where the train enters California, there is an Indian reservation, and at the railway station the haughty braves who disdain to offer their wares are not loath to part with them for a few dimes. At Los Angeles, Mexican and Indian curios have well nigh disappeared, although here and there old Californian baskets are to be had, but they command a good price. Orangewood comes again into notice, and slabs of it in all sizes, from a few inches up to a foot or more, are to be had with attractive paintings of either the leaf, blossom and fruit of the tree itself or with the more somber representations of one of the old mission churches that are in the immediate vicinity.

Naturally there are curiosity shops at the delightful seaside resort of Coronado Beach, opposite San Diego. A small herd of ostriches are kept there on exhibition to show the development of a new American industry. An egg, emptied of its contents, or one of the plumes can readily be purchased. Polished abalone shells are found, and the green variety is not so scarce as further north. The shells themselves are often to be picked up on the beach. I remember fans made from a little burrowing owl being sold at Coronado. The wings are spread around the body in a semicircle, and, to say the least, they are pretty souvenirs. The Mexican owls are more expensive.

The red variety of the abalone shell that attracted my fancy was one I found in Monterey. At Santa Cruz seaweeds pressed and grouped on cards seemed common, but they were without interest. A few miles north of Santa Cruz is a group of big trees, and there I secured a square board of the mottled pine with which when polished book covers can be made. I use it as a cover for a portfolio to hold some engravings of the old missions that were purchased in San Francisco.

If there were no other object in view, the magnificent drive of twenty-six miles up Mount Hamilton to the Lick Observatory is worth taking for its delightful experience, to say nothing of the views that are seen as the mountain is ascended. I hope Professor Holden will pardon me if I recall as a souvenir of my visit to Mount Hamilton the print of a photograph of the moon taken at the observatory which he signed for me, and which now hangs in my library, framed crudely in some wood from branches from trees that I cut in descending the mountain.

Chinese curiosities are naturally what are to be found most abundantly in San Francisco. A dirk knife in a carved bone case from Tong Yeun, in Jackson St., is a reminder of a visit to Chinatown, while a knife concealed in an imitation fan is also a trophy from the Chinese quarters. In Oakland it was quite possible until recently to purchase jewelry, such as sleeve buttons and scarf pins, made with thin sections of gold quartz showing the metallic veins set in California gold, and I understand that San Francisco jewelers make some very handsome souvenirs in California gold of different shades for tourists. It is also possible to procure the tiny gold fractional parts of a dollar which were coined at the United States branch mint in San Francisco some years ago. They are no longer made, and certain dates command a premium among numismatists.

There is a Chinese quarter in Portland, Oregon, and there again one may gather curios from the Orient if he so desires. A pack of Chinese playing cards that cost me a trifle, perhaps "two bittee," is the result of an evening's stroll among the haunts of the Celestials. In the vicinity of Puget Sound, as in Tacoma and Seattle, Indian curiosities, chiefly those made by the Indians from Alaska, who come down for a short while during the autumn to pick hops, are to be had. Closely woven baskets, such as those seen in Southern California, are found and also the stone carvings, representing totem poles. In Victoria and Vancouver, in British Columbia, similar curios may be purchased, including spoons made from the horns of buffaloes or perhaps more correctly bisons; also woven mats from Alaska and silver bracelets purporting to be made by the natives, but which are said to be made in Victoria by Indians in order to supply the tourists' demand.

Coming east from the Pacific coast, skins are sometimes procurable, but horns are more common, and frequently a pair of antlers can be picked up from the heaps that are seen in the vicinity of the railway stations. Doubtless here and there bead work can be had, but I failed to find any. It is at Niagara Falls and similar resorts that much of the Indian beadwork made into cushions and the like is to be found.

Indian pipes or calumets made from the mineral catlinite may be bought in the Northwest, and at Sioux City are the works where the agatized wood is cut into slabs, some of which are made into clock faces and the like. These are also to be had in St. Paul. What to look for in Chicago is indeed a question. Relics of the great fire are presumably no longer obtainable, but I well recollect a little bell that purported to be made from the molten metal of the big bells of the City Hall that were common in 1873. Probably souvenirs of the World's Fair held in 1893 would be more easily obtainable. There were many such, and perhaps something has been made from the material of the buildings that were torn down. Exquisite bronzes reproducing in miniature the animals that were conspicuous on the grounds, notably the grizzly bear by Proctor, were made, but they were very expensive. The Columbian half dollars or the Isabella quarters are not bad reminders of the Exposition, and even the tickets of admission, especially those that were so beautifully engraved, are well worth preserving.

At Cincinnati there is the Rookwood Pottery, and its products are everywhere conceded to be exquisite works of art. The "aerial blue" coloring is one of the latest of its many styles and is the most admired by some. The rare Matt Morgan, Kezonta, and Avon wares were also made in Cincinnati, but the potteries where these were produced have long since ceased to exist. Curious pieces of pottery are also to be had in East Liverpool and Steubenville, Ohio. The usual run of curiosities are to be had at Niagara; besides the Indian beadwork already mentioned, birch canoes can be purchased, but most of the articles on sale are from elsewhere, especially the agates. A fossil lingula from the Niagara limestone, found along the line of the river, came to me from the hands of Joseph LeConte, one of the greatest of American geologists, is a souvenir of a visit to the falls with a party of geologists. As we come nearer home I am reminded of a day spent in Utica searching for the American imitations of the old Flemish blue stoneware. Unfortunately, the maker persists in adorning his wares with German legends, but still an interesting collection of "steins" can be procured. In Albany, an enterprising jeweler had made in Austria some articles of the brilliant decorated Hungarian glass, which, even though made in Europe, have designs that recall local events of the times of the Patroons.

In New England souvenirs run largely to pottery. Rare bits of the Chelsea faience are still occasionally to be found in Boston, where also is sold the Longfellow pitcher, which is of English make. The Low tiles from Chelsea are genuine American products. The witch jug from Salem, made at the Hampshire pottery in Keene, is also an American article, while the stranger vases of mottled clay from Gayhead are unique. Curious pipes are also to be had from Cottage City, where the Gayhead Pottery is. Tiles, plates and pitchers abound and are to be had with American views, such as the old tower in Newport or the homes of our New England poets. Here and there are glass factories, some of which afford things of interest. The amberine of reddish shaded glass, the Burmese, the Sicilian and the peach blow are among the varieties of interest, none of which are now made, as far as I know, that were found in the show rooms of the glass makers in New Bedford, some years ago, while the old cut glass of Sandwich is held at fancy prices.

No mention of souvenir spoons has been made, and yet the time will come when the better varieties of these will be highly prized by those who were wise enough to collect them when the craze was on. There can be no doubt, it seems to me, that by a judicious selection of the curiosities sold in this country one can fill one's home with interesting "Things American," many of which will recall pleasant visits to various sections of the Union.

THE TOMATO GRAFTED UPON THE POTATO.

THE origin of grafting is very ancient. This is not the place to reproduce the history of the art, which is given in special works, but it is likely that man learned it in nature. Who has not seen examples of natural grafting in the woods between the branches or trunks of trees, or the branches of a thick bush?

Nevertheless, as easy as grafting is in many cases, a person who is not up in the art will be amazed upon opening a manual of arboriculture to see the number of varieties of grafts that have been devised by nurserymen and horticulturists, and the knowledge that has had to be acquired in order that the operation may never prove unsuccessful. The great trouble has been and is still to ascertain the affinity between the subject that is to receive the graft and the plant whence the scion is derived. In fact, it is necessary that the anatomical elements of the plants brought into contact

TOMATO GRAFTED UPON THE POTATO.

shall be as similar as possible and that their multiplication shall occur at the same epoch, in order that such elements may unite intimately, and that the graft, firmly fixed, may give the results that are expected from it. Much has been written upon this subject, which is not yet exhausted. However, all are agreed upon one point, and that is that it is indispensable that the plants associated shall belong to the same family, if not to the same genus, in order that the graft may take. If there are any exceptions to this rule, they must be very rare. It is curious to find, even, that some species placed very near each other in classification absolutely refuse to unite, and that the adhesion of others proves of short duration. We may here quote a few remarks from the pen of a master in the art of grafting:

"The explanation of the sympathies and antipathies in the grafting of different species is still wanting. No explanation, either, has been given as to why certain genera can be grafted upon others without the reciprocal being possible. For example, the apple does not succeed upon the pear; while we have seen the latter living for some years upon the former. The pear adopts the quince, and even the white thorn, as a subject, but these plants do not render the same service to their ally. The service, medlar, quince and quickbeam, which are so unlike each other and the white thorn, all sympathize with the latter. The peach and apricot graft upon each other with difficulty, while both succeed upon the almond and plum. All the cherries graft upon the mahaleb, but the latter grafts upon no cherry."

The number of such examples that have been revealed by experiment, but that it is almost impossible to foreknow a priori, might be still further increased.

Grafting has rendered and is still rendering great service in the multiplication of sarmentous plants such as clematises, or, again, of peonies, and even of certain arborescent species which are refractory to propagation by slips; and it is then upon roots that the grafting is practiced, the subjects selected being vigorous species or varieties always belonging to the same genus.

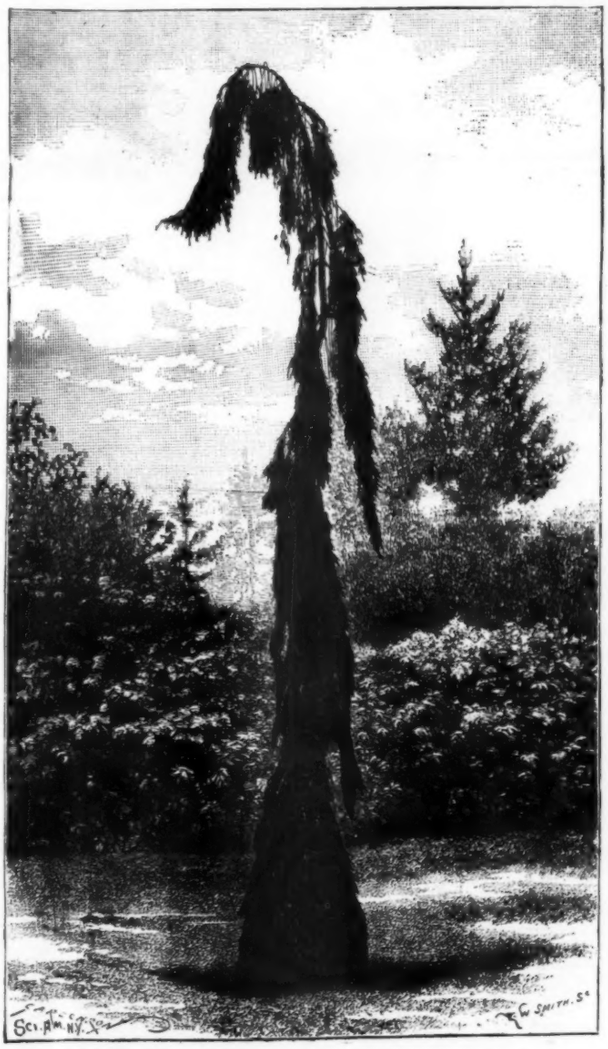
It is also possible to graft annual plants when these have stalks or branches that are sufficiently fleshy, and a striking example of this is shown in the accompanying engraving. It cannot be said, however, that this process has entered into practice, and up to the present it has been merely a matter of curiosity. Carrière, who was a practical man and an indefatigable investigator, tried the most diverse kinds of grafting, and among other results, obtained a crop of tomatoes upon stems of the bitter-sweet. Mr. C. Baltet, an experimenter of

the first rank, has attempted to graft the most diverse plants and has brought together, in a work entitled L'Art de Greffer, very useful directions and advice as to grafting and information as to the species that can be multiplied with certainty by this process.

In grafting branches of the tomato upon stalks of the potato plant, M. Baltet's son has made an interesting experiment that realizes the utile dulci of Horace upon one and the same plant, and which merits being placed before the eyes of our readers, to whom it will show the affinities of two plants belonging to the same order (Solanaceæ) and the possibility of grafting plants which have an ephemeral existence in some regions and which, at first sight, would not seem to be capable of giving so curious results.—La Nature.

THE WEEPING SPRUCE.

OF all our common conifers, the spruce, Picea excelsa, is the most prolific in variations. Some of these are of extraordinary character, some elegant, others ugly. Of pendulous varieties there are several, but none more remarkable than the one figured in our illustration, from a photograph kindly forwarded to us by Mr. A. D. Webster, the superintendent of Greenwich Park. The tree, which measures 30 feet in height, is growing



A WEEPING SPRUCE AT IDE HILL, SEVENOAKS, KENT, ENGLAND.

at Ide Hill, Sevenoaks, Kent. We are indebted to the Gardeners' Chronicle for the engraving and particulars.

MARINE PHOTOGRAPHY.

MARINE photography has its peculiar charms. It has also its special difficulties. If the amateur is to derive any satisfaction at all from his "snapshots," he must give a little preliminary study to the nature of the task which he sets himself. It is not enough that he should include among his luggage marked for cabin use, when he boards some oceangoing steamer, or pleasure yacht bound upon a foreign cruise, a two-guinea hand camera with which to secure pictures upon his voyage. With this he may or may not succeed. Chance may favor him or it may reduce him to despair, and he may be tempted to throw up photography as an art which is beyond his aptitude, when, if he only knew the truth, the fault rested rather with the insufficiency of his apparatus than with his want of skill. Success in taking photographs at sea depends very greatly upon an appropriate choice of a camera, and upon what may be termed the modesty of the operator's ambition. Let him first make up his mind what he intends to do, and then let him provide himself with the best possible means of accomplishing his purpose, and, above all, let him not entertain the fancy that with one description of camera he can exhaust the possibilities of marine photography,

The range presented to the devotee of the camera on shipboard is immense. It may be limited to "taking" one's fellow passengers or the sailors, and if it goes no further than this, hand cameras of the customary description may do. But if mere amusement be not the object, if the camera is to serve a really practical and useful purpose, especially if it is to assist the navigator by obtaining permanent records of collision, or damage resulting therefrom, or by securing pictures of coast lines and the like, then something more than a scientific toy is demanded. Intelligent application, and not the mere capricious love of timekilling in an amusing fashion, must stimulate the operator, or he will assuredly fail. And the first thing to recollect is that the photographic lens has a limited vision after all. You have no right to expect of it the wonderful, transcendental powers attributed to the tremendous telescope immortalized by Mr. Weller. It is idle to suppose that it will see with equal distinctness the minute products of deep sea soundings and the distant steamer two miles away. Of course it is possible to strike a happy mean between these two, and the result will be gratification rather than disappointment. But one must bear in mind that short sight and long sight are not reconcilable. If you peer with your camera into the hedgerow, you must not feel aggrieved if it does an injustice to the horizon. And the point is emphasized at sea. One may make certain of a very good negative of the launch of a boat right under the eye, and yet fail to bring two steamers approaching each other within the limits of the plate.

Perhaps marine photographs are especially deceiving, in that they appear to magnify distances. A tugboat plowing its way along one of the reaches of the Thames, as seen in the print, gives one the impression that the camera was at a considerable distance from it; yet, in actual fact, the point of sight was only a few yards removed from the object taken. One difficulty of securing a picture at sea lies in the fact that a considerable space must intervene between the object and the operator, whereby everything is so much dwarfed.

The Diamond Jubilee Review afforded interesting proof of this contention. Various efforts were made to get a satisfactory photographic record of the great naval display, but they have all failed. Perhaps the most successful have been the panoramic pictures obtained by composite printing; but it must always be recollected that a panorama can never be regarded as one picture—it is a series of subjects placed in consecutive order. People who have gone to animated photographic displays with the expectation of enjoying some picture of the review in its entirety have been disappointed. They have come away with a very fair notion of individual battleships, with the incidents around them, such as the passing of a yacht, guard boat, or excursion steamer, but they have not been given a comprehensive idea of the whole fleet. It has been left to the imagination of artists to limn the scene as they supposed it to be, not as they saw it themselves; for the human eye is less powerful than the lens, and where the latter falls short it cannot be supposed that the naked vision can succeed.

As an example of what can be done by the photographer, the work of a clergyman may be instanced. Into one of his pictures of the naval review he did squeeze from twenty to thirty warships. His plate was 10 inches by 8 inches and he was compelled to station himself two miles off, and to use a telephoto attachment, which enlarged each object five diameters—that is, five times. Yet, in the print, all his ships are extremely small—not more than $\frac{5}{8}$ inch in length; and if he had used a $\frac{1}{4}$ plate camera, they would not have been $\frac{1}{8}$ inch in size.

It may be gathered from this that it is of not much use to attempt to photograph at a great distance. Yet what is two miles to a vessel going eighteen knots an hour? It is a matter of a few minutes' steaming only, and anyone who may attempt a sketch of a rugged coast from the deck of an approaching steamer, traveling at any rate, will at once perceive how in a few seconds the picture changes so as to be completely altered from the moment that the first stroke of the outline was drawn. Say, for instance, you are steaming toward Corbière Lighthouse from Jersey. The headland from which it juts out acquires a different form as you draw nearer, and the pyramid rocks themselves gain not only in definition, but change their shape as the course of the steamer alters on its way to Guernsey. These transformations are so rapid that only an instantaneous view can take note of them; yet, from the artistic standpoint, there is but one crucial moment when the picture of the Corbière is at its best, and it is precisely at that instant it should be "snapped."

Makers of photographic instruments are, of course, fully alive to the requirements of the marine photographic artist. It was from one well known firm—Messrs. William Watson & Sons, of 313 High Holborn—that Mr. A. Debenham, of Ryde, procured the 18 inch by 16 inch rapid rectilinear lens with which he took the magnificent picture of the Prince of Wales' yacht "Britannia," racing at full speed; and the same makers have, at different times, supplied other photographers, many of them of high social standing, who have turned their attention specially to this branch of the art. Among them may be named the late Lady Brassey and her daughter Beatrice, from whose negatives the Voyage of the "Sunbeam" was illustrated. Lady Brassey's method was this. She sat on deck in a chair, and a very heavy upright pole, 5 inches in diameter, something resembling that of a surveying instrument, was fitted into a socket in the deck, and on the top a mechanical arrangement, into which the camera was screwed, always kept the camera square in front of her, however much the boat might rock.

It may be taken for granted that a tripod cannot be used on board ship; the vibration is too great; although Captain Owen, late of the Union Steamship Company, has, I believe, employed one amidship, but only on exceptionally fine days and when the sea has been quite smooth. This officer is unrivaled in his yachting pictures, some of which may be seen at the Imperial Institute. It is his plan to sit in a little cabin on his yacht, and by mechanical means he can turn himself round to any point of the compass, so that he can always keep the yacht that he may be following in the field of his lens, until the supreme moment arrives for snapping it.

The question may naturally be asked, "When can the snapping time be determined?" Of course the use of "finders," as they are called, is well understood, but there are finders and finders. Mr. Debenham, as he goes about in his stout little dingey, often uses an ordinary finder, but Captain Owen, when he works on a large scale—i. e., with plates 10 inches or 12 inches square—employs a double camera. The two cameras are mounted on one baseboard, side by side. They have one focusing screw and one traveling frame, so that the coincidence is accurately kept. The view is watched in the left camera, which is hence the finder, and an exposure is made in the right just at the moment that the picture is perfect. In this finder the operator sees the object exactly under the same conditions as the companion camera secures it on the plate, which is a great advantage.

But amateurs who have not such serious work in mind may be content with a less elaborate apparatus. Watson's double camera has also twin lenses, but placed one above the other and not side by side. The finder is uppermost. When you raise the hood you see the image, full size, reflected upon a sheet of ground glass at the top of the camera by a mirror placed at right angles to the lens. This camera has also the advantage of permitting the operator to watch and wait for the most appropriate moment of exposure, when he squeezes the pneumatic ball, the use of which insures steadiness, and the trick is done. Hitherto, the principal drawback of a double camera has been the bulk, but this pattern is very little larger than an ordinary camera. Its dimensions for the half-plate size are $8\frac{1}{2}$ by 9 by 10, and weight complete 9 pounds. It is particularly adapted for use in the hand, and its great advantage is that the object can be focused up to the moment of exposure with absolute certainty of result. Such a camera, therefore, can be confidently recommended for work on board ship. Nothing is left to chance. You see your picture as you take it.

Now, is there any reason why this camera should not be further adapted for marine pictures? These are apt to be long and narrow, especially where long focus lenses are used. It would be an advantage in photographing a coast line, or a seascape, to use a $7\frac{1}{2}$ inch by 5 inch horizontal plate; but this modification would involve an increase of bulk and weight. This consideration, however, might at sea be dismissed as of secondary importance. Of far greater necessity on board a large ship—it is not so essential on a yacht—is the long focus lens; and in the building of a camera specially suitable for marine work care should be taken that such lenses are included in the outfit. But you cannot expect them to do duty when snap-shotting your fellow passengers. It would be as unreasonable as to use field glasses for reading an evening paper under your eyes.

The still less aspiring amateur, who does not aim at making long focus pictures a specialty, may very well be content with the lighter and inexpensive Vanneck hand camera, which has but one lens. The view finder is in the middle of the top of the box, and shows the same picture as is being taken on the sensitive plate, less the margin of the plate. The one lens is so arranged that when the image is seen sharply it is necessarily in focus on the plate. A turn of a screw immediately sets any object seen, near or distant, into perfectly sharp focus. With this camera you may use in one size a 4¼ by 3¼ inch glass plate or cut celluloid film, which is preferable to a roll film, or one of 3¼ by 3¼ inches. A dozen sensitive plates are contained in a holder at the back of the box, and at the top of the reservoir is a flexible bag into which the plate is raised by a lever, and thence lifted to the front ready for exposure when the spring is pressed. The Vanneck is most suitable for all general hand camera work, and, with an outer leather case, especially recommends itself to travelers.

One thing, in conclusion, must be borne in mind. Cheap cameras are usually costly in the end, and a good camera is worth its price.—J. H. Richardson, in Nautical Magazine.

A NEW STEAM PROPELLED AEROPLANE.

THE French Academy of Sciences recently received a description of an air ship constructed by Messrs. V. Tatin and Charles Richet. This new apparatus considerably exceeds Prof. Langley's aerodrome in size and speed. Langley's apparatus weighed about 22 pounds, and a speed of over 12 yards per second was obtained. The Frenchmen have produced an apparatus weighing 73 pounds and developing a speed of about 20 yards per second. The figures given include a water supply of 3 liters (weighing about 6½ pounds) and 600 grammes (about 1¼ pounds) of coal, sufficient for a flight of 5 kilometers, or a little more than 3 miles. So far, however, the longest flight has been only 140 meters (155 yards), the apparatus having a strong tendency to take headers. In this respect it is distinctly inferior to Langley's. The new apparatus cannot be experimented with except in perfectly calm weather, and even then it was necessary to start the machine on an absolutely horizontal flight, or it would tip over and come down suddenly.

The aeroplane consists of a very light frame of thin wood covered with silk. Attached to this frame are two fixed wings of like construction and of an area of 14½ square yards. The wings are connected with the body by steel wire. The machine further has a tail made of a wood frame and silk covering. A steam engine is used to drive two screw propellers, one of which is placed fore and the other aft, the two screws rotating in opposite directions.

To start the apparatus, it is placed on a car rolling down an inclined plane of 82 yards length and 11 yards height. At the end of the inclined plane an automatic appliance severs the connection between the car and the aeroplane, and the latter then proceeds on its free flight. The inventors are continuing their experiments, particularly in order to improve the conditions of equilibrium in their machine, and they hope to secure much better results when improvements have been made.—Der Stein der Weisen.

INCREASE OF RAIN IN MODERN TIMES.

"ACCORDING to M. Camille Flammarion," says the Literary Digest, which translates from La Génie Moderne, "who has compared all the hydrometric observations made at the Paris Observatory for about two hundred years, the amount of rain that falls in our regions is increasing yearly. This increase may be seen at the first glance by examining the averages of different periods. From 1689 to 1719 there fell an average of 485·7 millimeters [191·2 inches] of water:

"From	1720 to 1751	409·4
"	1773 " 1779	492·5
"	1804 " 1834	503·7
"	1825 " 1844	507·5
"	1845 " 1872	522·4
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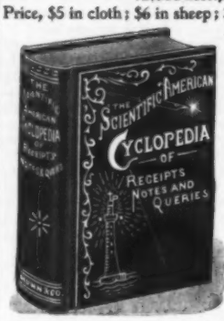

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